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Updated Estimates of Harp Seal Removals in the Northwest Atlantic

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Foreword

This series documents the scientific basis for the evaluation of aquatic resources and ecosystems in Canada. As such, it addresses the issues of the day in the time frames required and the documents it contains are not intended as definitive statements on the subjects addressed but rather as progress reports on ongoing investigations.

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ABSTRACT

The Northwest Atlantic harp seal (*Pagophilus groenlandicus*) is hunted for subsistence purposes in Greenland and the Canadian Arctic, and as part of a commercial catch in southern Canadian waters. In addition to reported catches, animals are killed but not landed or reported ('struck and lost'), and are taken as by-catch in commercial fishing gear. Information on catch levels and age structure of removals are necessary for accurate population estimation and responsible management. The objective of this report is to update estimates of removals for the period 1952-2013. Commercial and subsistence hunts account for the majority of the removals. Canadian commercial catches averaged around 288,000 harp seals prior to the introduction of quotas in 1972. Between 1972 and the demise of the large vessel hunt in 1982, an average of 165,000 seals was taken annually. Catches decreased after 1982 and remained low, averaging approximately 52,000, until 1995. Annual catches, consisting primarily of young of the year, increased to an average of 272,600 between 1996 and 2006. Beginning in 2007, catches declined due to ice conditions and poor markets, reaching a low of approximately 40,389 in 2011. Over the past decade, the vast majority of seals taken were between 1 and 3 months of age with over 99 % of the seals taken since 1999 have been one year of age or less. Since 1980, Greenland catches increased relatively steadily to a peak of approximately 100,000 in 2000. Since then, catches have fluctuated between 65,000 and 90,000 per year. There are no recent estimates of the age structure of seals taken in Greenland but the available data indicate that a significant proportion of seals taken are adults. Catches in the Canadian Arctic are not well documented but appear to be low with likely fewer than 1,000 harp seals taken annually in recent years. Estimates of harp seal by-catch in the Newfoundland lumpfish fishery increased from less than 1,000 in the early 1970s to a peak of 46,400 in 1994. Since then, estimates of this type of by-catch declined to approximately 5,000 by 2003. Although lumpfish catches have generally remained low, actual by-catch levels are unknown. Low numbers of harp seals are also caught in United States (US)-based fisheries. Combining the various sources of mortality, the average total removals from 1952-82 was approximately 388,000, but declined to 178,000 per year between 1983 and 1995. From 1996-2004, higher catches in Canada and Greenland resulted in average annual removals of 472,700. Since 2008, reduced Canadian catches have lowered total removals to an average of 245,500 harp seals per year. The greatest uncertainty in these estimates are associated with the Greenland catch, and struck and lost rates, although changes in the latter are unlikely to affect the abundance estimates significantly.

Estimations à jour des captures de phoques du Groenland dans l'Atlantique Nord-Ouest

RESUME

Le phoque du Groenland de l'Atlantique Nord-Ouest (*Pagophilus groenlandicus*) est chassé aux fins de subsistance au Groenland et dans l'Arctique canadien, ainsi que comme prise commerciale dans les eaux du sud du Canada. En plus des prises recensées, des animaux sont tués, mais ne sont pas débarqués ou consignés (« abattus et perdus ») ou sont pris comme prises accidentelles dans les engins de pêche commerciaux. Il est nécessaire d'avoir de l'information sur la quantité de prises et la structure par âge des captures afin de faire une estimation exacte de la population et une gestion responsable. Le but du présent rapport est de mettre à jour les estimations de captures disponibles pour la période entre 1952 et 2013. La majorité des captures sont liées à la pêche commerciale ou de subsistance. Les prises commerciales canadiennes étaient en moyenne de 288 000 phoques du Groenland avant la mise en place des quotas en 1972. De 1972 jusqu'à la fin de la pêche par les navires en 1982, 165 000 phoques ont été capturés en moyenne chaque année. Le nombre de prises a diminué après 1982 et est resté faible, étant en moyenne d'environ 52 000 animaux jusqu'à 1995. Les prises annuelles, consistant principalement en des jeunes de l'année, ont augmenté jusqu'à une moyenne de 272 600 entre 1996 et 2006. À compter de 2007, les prises ont diminué en raison des conditions de la glace et du marché peu favorable, atteignant un creux d'environ 40 389 phoques en 2011. Au cours de la dernière décennie, la grande majorité des phoques capturés étaient âgés de 1 à 3 mois, plus de 99 % des phoques capturés depuis 1999 étant âgés d'un an ou moins. Depuis 1980, les captures au Groenland ont augmenté de façon relativement stable, atteignant une crête de 100 000 animaux en 2000. Depuis, le nombre de prises a varié entre 65 000 et 90 000 par année. Il n'y a pas d'estimations récentes sur la structure par âge des phoques capturés au Groenland, mais les données disponibles indiquent qu'une proportion importante des animaux capturés étaient des adultes. Les prises dans l'Arctique canadien ne sont pas bien documentées, mais le nombre semble bas, étant probablement inférieur à 1 000 phoques du Groenland capturés chaque année au cours des dernières années. Les estimations pour les prises accidentelles de phoques du Groenland lors de la pêche à la lompe à Terre-Neuve ont augmenté, passant de moins de 1 000 animaux au début des années 1970 à un sommet de 46 400 phoques en 1994. Depuis, les estimations pour ce type de prises accidentelles ont diminué à environ 5 000 animaux en 2003. Même si le taux des prises de lompe est habituellement faible, le niveau de prises accessoires réel est inconnu. Un nombre peu élevé de phoques du Groenland sont aussi capturés par les pêches américaines. En combinant les diverses sources de mortalité, le nombre moyen de captures totales entre 1952 et 1982 a été d'environ 388 000 animaux, mais a diminué à 178 000 par année entre 1983 et 1995. De 1996 à 2004, un nombre plus élevé de prises au Canada et au Groenland a donné une moyenne de 472 700 captures annuelles de phoques. Depuis 2008, le nombre réduit de prises au Canada a entraîné une diminution du total des prises à, en moyenne, 245 500 phoques du Groenland par année. La plus forte incertitude dans le cadre de ces estimations concerne les prises au Groenland et les taux d'animaux abattus et perdus; cependant, les changements quant à ces derniers ne sont pas susceptibles d'avoir une incidence importante sur les estimations de l'abondance.

INTRODUCTION

Accurate information on the level of mortality is critical when attempting to estimate abundance of any population. In the case of Northwest Atlantic harp seal (*Pagophilus groenlandicus*), total mortality is comprised of 'natural' (i.e. not identified) mortality, environmentally mediate (ice) mortality of Young of the Year (YOY) and human induced mortality. The ice related mortality has been estimated using ice cover as an index (Hammill and Stenson 2013) while 'natural' mortality is estimated within the population model (e.g., Roff and Bowen 1986; Shelton *et al.* 1996; Healey and Stenson 2000; Hammill and Stenson 2011; Hammill *et al.* 2011, 2012). Identified sources of mortality directly due to humans are the Canadian commercial seal hunt, subsistence harvests in Greenland and the Canadian Arctic, animals that are killed but not landed during commercial or subsistence hunts and therefore are not accounted for in the catch statistics, and incidental catches in commercial fishing gear (i.e. by-catch). Data on the levels of various components of this mortality have been compiled previously (e.g., Lavigne 1999, Stenson *et al.* 2000, Walsh *et al.* 2000, Sjare and Stenson 2002, Stenson 2005, 2008) and summarized up to 2009 by Stenson (2009).

The objective of this study is to update available estimates of Canadian and Greenland catches, by-catch, and stuck and lost to produce an estimate of human-induced removals in the northwest Atlantic up to 2013. These data will be used as input to a population model to assess current abundance of Northwest Atlantic harp seals.

DATA AND DISCUSSION

COMMERCIAL AND SUBSISTENCE CATCHES

Northwest Atlantic harp seals are taken in the commercial hunt in southern Canadian waters (i.e., off southern Labrador and/or the northeast coast of Newfoundland ('the Front'- the Northwest Atlantic Fisheries Organization [NAFO] Divisions 2J and 3KL), and the Gulf of St. Lawrence ('the Gulf'-NAFO Division 4STVn), and in subsistence hunts off western and southeastern Greenland (NAFO Division 1A-F; International Council for the Exploration of the Sea [ICES] Area XIVb), and the eastern Canadian Arctic (primarily along the east coast of Baffin Island). Reported catches for each of these areas are summarized in Table 1 and illustrated in Figure 1.

Front and Gulf

Historical catches of harp seals were reviewed by Stenson (2009). Although harp seals have been harvested commercially in Atlantic Canada since the 1700s, the highest level of catches occurred in the early to mid-1800s with an average of over 470,000 seal skins exported annually from Newfoundland between 1840 and 1850 (Ryan 1994). Following this period, catches declined significantly to a low of 15,300 per year during World War II (Fig 2). Lett and Benjaminsen (1977) presented the first comprehensive age structure of the harvest for the period from 1952-75. Subsequently, inconsistencies in the data were corrected and updated estimates of Canadian and Greenland catch were provided in Bowen (1982), Sjare *et al.* (1996), Stenson *et al.* (1999a, 2000) and Stenson (2005, 2008, 2009). Catches up to 2008 were taken from Stenson (2009).

Prior to the imposition of quotas in 1972, catches at the Front and in the Gulf were highly variable, ranging from 188,000-389,000 (average 288,000; SD=52,700; Table 1, Fig. 3). Between 1972 and 1982, the varying Total Allowable Catch (TAC) (Anon. 2004) resulted in an average catch of 166,000 (SD=21,300; range 124,000-202,000). From 1983 through 1995,

catches were reduced (average 52,000; SD=21,300; range 19,000–94,000). In 1996, however, catches increased significantly (243,000) and, with the exception of 2000, continued to increase, reaching a maximum of almost 366,000 in 2004. From 2003–05, the TAC for harp seals in the Canadian commercial hunt was based upon a management plan that allowed for a total of 975,000 seals over 3 years with a maximum of 350,000 in any one year. Since then, TACs were set annually to ensure that the population did not decline below the precautionary reference level (i.e. N70 or 70 % of the maximum population size) within a 15 year period (Hammill and Stenson 2007). Between 1996 and 2006, an average of 272,671 (SD=73,016) seals were taken annually.

Catches have steadily declined since 2006 when 354,867 harp seals were reported taken (1.06 % of the TAC; Table1, Fig. 3). However, the statistics for this year assumed that 2,000 seals were taken in the Canadian Arctic which double the level assumed to occur by Stenson (2009). In subsequent years, Arctic catches were not included in the estimates. Catches were significantly reduced in 2007 (224,745, 83 % of TAC) due to the lack of ice in the southern Gulf and heavy ice off Newfoundland. Poor ice, offshore distribution and low prices also resulted in lower catches in 2008 with only 79 % (217,850) of the TAC taken. Although quotas have been increased, catches in recent years have been extremely low, falling to less than 80,000. In 2011, only 40,389 (10.1 % of the TAC) were taken due to a combination of poor ice conditions, reduced effort and alternate fisheries. Since then, catches increased slightly reaching 90,703 (22.7 % of the quota) in 2013.

The age structures of catches during the 1952–83 period were taken from Bowen (1982) and Roff and Bowen (1986). For the period 1984–2008, the age structure of seals harvested was estimated in the same manner as Stenson (2009). The catch statistics provided by the International Commission for the Northwest Atlantic Fisheries (ICNAF), NAFO and Fisheries and Oceans Canada (DFO) Statistical Branch are reported according to pelage type. Based upon these reports, Front and Gulf catches can be split into YOY (age class 0) and seals one year of age and greater (1+) (see Table 1). The numbers of 0 age class seals taken annually were obtained directly from these data. The only exceptions occurred in 1998 and 1999 when a portion of the catch was not identified according to pelage. The age of 7 % of the catch was not identified in 1998. It was assumed that the proportion of age class 0 in this catch was the same as for the remainder of the catch for which ages were available. In 1999, approximately 22 % of the catch did not have assigned ages. As these animals were all from the Gulf of St. Lawrence, the age structure of seals taken by the small boats in the Gulf (which were reported by age) was used. Young of the Year accounted for 98 % of these seals which was consistent with reports from the area.

Prior to 2001, the proportion of 1 + animals in the catch was estimated on an annual basis based upon biological samples collected primarily in Newfoundland and the northern Gulf. Most of these samples were obtained from commercial sealers distributed throughout Newfoundland and Labrador who were requested to retain some or all of their harvest for sampling. Additional samples were obtained from research sampling programs conducted by DFO personnel during which seals were collected for biological samples. In the latter case, animals were taken during the late winter or spring moult in a manner similar to the commercial hunt. Samples obtained as by-catch and seals taken during the month of March (whelping period) have been excluded due to potential biases in the age ratios. Samples obtained by collectors who exceeded their quotas and sub-sampled their catch were also excluded. The majority of samples obtained from sealers came from hunters operating small boats. In recent years a greater proportion of samples have been obtained during the longliner hunt, reflecting the increasing importance of this component of the harvest.

Given the small numbers of 1 + seals taken in the harvest (in some years 0) and the difficulties in obtaining representative samples, the average proportion at age from 1996-2000 (Table 2) was used to assign 1 + catches since 2001. This assumption is unlikely to have a significant impact on the estimates. The estimated number of seals in each age class caught in the Front and Gulf region from 1952-2009 are presented in Table 3.

During the 1950s and early 1960s the proportion of young (age class 0) in the catch ranged from 47 % to 89 %, although in most years young made up 60-80 % of the catch (Fig. 2). From 1963-83 young accounted for over 78 % of the catch in practically every year. The majority of these young were whitecoats taken during the large vessel hunt on the whelping concentrations. The proportion of young in the catch remained relatively high (70 -80 %) during the mid to late 1980s but was reduced to 40 -60 % during the first half of the 1990s (Table 2, Fig. 3). Since the mid-1990s, the hunt has been directed towards moulted YOY seals 1-3 months of age (i.e. beaters). Year of the Young seals have accounted for 95 % of the harvest or more since 1999 and more than 99 % of the seals taken since 2008.

Greenland

The Joint ICES/NAFO Working Group on Harp and Hooded Seals (Anon. 1998) examined the issue of stock identity of the Greenland harvest and concluded that all catches from west Greenland, and half of the catch from south-east Greenland should be considered to have come from the Northwest Atlantic harp seal stock. The Greenland catches presented in Table 1 reflect this allocation. Greenland catches for the years 1952 and 1953 were taken from Bowen (1982) and for 1954-2011 from Anon. (2013). No data are available from 1988-92 and, following Stenson (2009), catches were estimated by linear interpolation using the corrected catch totals in 1987 and 1993 as 'endpoints'.

Prior to 1975 reported catches varied from 4,000-19,000 (average 10,000; SD=4,000) with generally slightly higher catches in the 1950s than in the 1960s and early 1970s (Table 1, Fig. 4). From the mid-1970s up to 1996, catches increased relatively consistently from approximately 7,000 in 1975 to approximately 100,000 in 2000. Since then catches appear to have stabilized and have fluctuated between 65,000 and 90,000. In order to estimate total removals in 2012 and 2013, catches were assumed to be the same as the average over the past decade for which data were available (78,694).

Prior to 1982, Greenland catches accounted for less than 10 % of the total harvest in the Northwest Atlantic. However, with the increased catches in Greenland and decreased Canadian catches, Greenland accounted for almost half of the total reported annual catch in most years between 1984 and 1995. With the increased Canadian catches since 1996 and the decline in Greenland catches after 2000, the proportion of total reported catches taken in Greenland declined to 16 - 18% of the reported catch between 2002 and 2008. With recent declines in the Canadian catches, however, the Greenland hunt has accounted for approximately half of all seals reported taken since 2008.

No new data on the age composition of catches in Greenland are available. Hunters in Greenland report the proportion of their catches that they consider to be 'adults' (Anon 2013). The harvest reports indicate that the proportion of adults in the catch increased from less than 25 % prior to the change in reporting in 1987 to approximately 50 % in the 1990s. Since 2005, approximately 1/3 of the seals taken were reported to be adults. Unfortunately, these estimates cannot be used to determine the exact ages of seals taken in Greenland due to uncertainty about the definition of 'adult' and variations in the ages of seals with different pelages (Rosing-Asvid, Greenland Institute of Natural Resources, Nuuk, Greenland, pers. comm.). Therefore, the age structure of catches were taken from Stenson (2009) and extrapolated forward to 2013

(Table 4). The estimated numbers of seals taken in each age class by Greenland hunters from 1952-2013 are given in Table 5.

Canadian Arctic

Catches of harp seals in the Canadian Arctic have not been well documented and there are no new data to estimate current catches. Information on historical catches in Nunavut were described by Stenson (2009). There are no estimates of catches in northern Quebec but the numbers are thought to be extremely small (M. Hammill, DFO, Quebec Region, pers. com.). Stenson (2009) assumed that subsistence catches in the Canadian north in recent years were in the order of 1,000 per year. This value was assumed to apply to all subsequent years (Table 1).

As there are no recent reports of Arctic harp seal catch at age frequencies, following Stenson (2009), I assumed that recent catches have remained at the proportions reported by Roff and Bowen (1986) (Table 6). The estimated numbers of Northwest Atlantic harp seals in each age class are presented in Table 7.

STRUCK AND LOST (S&L)

The proportion of seals that are killed but not recovered (i.e. 'struck and lost') will vary with the hunting method, skill of the hunter, location (e.g., on ice or in the water), weather conditions, age and condition of the seal, and the time of year (which is correlated with the thickness of the blubber layer in seals that lay down seasonal energy reserves)(Sergeant 1991, Lavigne 1999, NAMMCO 2006). Unfortunately, few data are available on the level of S&L in pelagic seals and most of it was collected before 1980. Lavigne (1999) reviewed available data on loss rates in older seals while Rowsell (1977) provided some data on loss rates for young harp seals (beaters) taken on the ice. Sjare and Stenson (2002) estimated S&L rates in the Canadian commercial harp seal hunt between 1998 and 1999. DFO (1999) recommended that S&L should be specifically identified as a removal for the purposes of assessing the population, even though it is unlikely to significantly impact the population estimates per se. This is because changes in the 'natural' mortality estimated by the model will be adjusted to account for differences in S&L levels.

Following the recommendations of DFO (2000) and following Stenson (2009), I assumed that recovery (and reporting) rates were 99% for YOY seals killed in southern Canadian waters prior to the end of the large vessel hunt in 1982 and 95% for first year animals after this whitecoat hunt ended. The recovery rate for 1 + seals taken in southern Canadian waters and all seals taken in Greenland or the Canadian Arctic was assumed to be 50 % (Table 8).

The level of S&L assumed for the Greenland hunt may be an overestimate. Ugarte and Jackobsen (2006) report preliminary results of a questionnaire survey of hunters to estimate the level of stuck and lost in the Greenland. They found that approximately 1/3 of the hunters reported that they included S&L seals as part of their catches. Also, the average level of S&L reported was 0.26 and 0.21 for leisure and professional hunts, respectively. The average monthly levels of S&L varies from 0.13 in October when seals were putting on weight to 0.35 in June when seals were lean following the moult. Sjare and Stenson (2002) estimated loss rates for 1 + seals taken during the Canadian commercial catch which occurs, primarily during the post-pupping period. They estimated S&L to vary between 0-21.6 % on the ice and 5.0-50.0 % when taken in the water. Based upon these results, reducing the struck and loss rates for adult seals should be considered in future assessments.

BY-CATCH IN COMMERCIAL FISHING GEAR

Harp seals are caught in commercial fishing gear, particularly bottom set gillnets, in many parts of their range (Woodley and Lavigne 1991, Lien et al. 1994, Read 1994). The primary source of mortality in Atlantic Canada is the spring Newfoundland lumpfish fishery (Sjare et al. 2005) which began in 1968. Although by-catch of harp seals likely occurred earlier, reports of large numbers of by-catch were not received until 1985 (Sjare et al. 2005). Based upon log book data and total lumpfish catches up to 2003, estimates of by-catch in this fishery were provided by Walsh et al. (2000) and Sjare et al. (2005) (Table 9). They also provided a breakdown of catches into young of the year (beaters) and seals one year of age and older. Prior to 1976, catches were generally below 1,000 seals. Between the late 1970s and early 1990s catches increased, reaching a peak of 46,000 in 1994. By 2003 catches had declined to a little over 5,000 seals. Since then total catches of lumpfish have generally been low but have varied considerably among years (DFO Statistics Branch, pers. comm). However, in the absence of any data on the fishing effort since 2003, the average catch, and proportion young, from 1999 through 2003 was applied to 2004-2013.

Data on incidental catches of harp seals in U.S. fisheries were summarized by Waring *et al.* (2005, 2010, 2013). Catch data were obtained by independent fisheries observers in the Northeast Multispecies Sink Gillnet, Mid-Atlantic Coastal Gillnet and North Atlantic Bottom Trawl fisheries. The majority of catches observed were in the sink gillnet fishery while only occasional catches occurred the other fisheries. Some estimates prior to 2008 (reported in Stenson 2009) have been revised. Catches in 2011-13 were assumed to be equal to the average catches for the past five years (Waring *et al.* 2013).

The proportion of young seals in the US catches was assumed to be the same as that observed in the Newfoundland lumpfish fishery. The age structure of 1 + seals was assumed to be the same as observed among the commercial catches in Canada. The estimated numbers of Northwest Atlantic harp seals in each age class taken as by-catch in commercial fisheries are presented in Table 10.

TOTAL REMOVALS

Combining the estimates of reported Canadian and Greenland catches, S&L, and incidental catches in commercial fisheries provides an estimate of human-induced mortality for Norwest Atlantic harp seals (Table 11, Fig. 5).

Prior to the imposition of Canadian quotas in 1971, total removals averaged 388,000 seals. The level of catches dropped to 226,000 for the 1972-82 period due to restricted catches in Canada. The end of the large vessel hunt in 1982 reduced the importance of the Canadian hunt while the Greenland component, particularly when S&L is considered, increased (1983-95, average=178,000). Increased catches in all areas significantly increased the total removals beginning in 1996, with an annual average removal of 472,700 between 1996 and 2008. Since 2008, reduced Canadian catches have lowered total removals to an average of 245,500 harp seals per year.

The proportion of YOY in the removals varied among year (Table 11, Fig. 6). During the period when the whitecoat hunt (1952-83) dominated, an average of 62% of the total annual removals was estimated to be age class 0. From 1982-96 the average proportion of young declined to 34 %, reflecting, in part, the greater importance of the Greenland harvest. The proportion of age class 0 subsequently increased, averaging 67 % for the years 2001-08. As a result of the lower Canadian catch and focus on YOY, the proportion of age class 0 has remained at 42 % since 2009.

Many aspects of removals in recent years are poorly known. The greatest uncertainty in these estimates are associated with the Greenland catch, and struck and lost rates. Given the number of seals taken in Greenland and the higher proportion of older seals in the catch, errors can have a significant impact. Additional data on S&L for 1 + seals would allow us to improve these assumptions although changing S&L is unlikely to change our understanding of the abundance significantly (Stenson et al. 1999). By-catch levels in Newfoundland lumpfish fishery may be overestimated in recent years if reductions in total catches reflect actual reductions in fishing effort. Improving our understanding of both the level and age structure of removals, particularly in Greenland, is required in order to improve our understanding of the population dynamics of Northwest Atlantic harp seals.

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REFERENCES

- Anonymous. 1998. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. ICES CM 1998/Assess:3.
- Anonymous. 2004. Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals. ICES CM 2004/ACFM:6.
- Anonymous. 2013 Report of the Joint ICES/NAFO Working Group on Harp and Hooded Seals (WGHARP). ICES CM 2008/ACOM:20.
- Bowen, W. D. 1982. Age structure of Northwest Atlantic harp seal catches, 1952-80. NAFO Sci. Coun. Studies 3: 53-65.
- DFO. 1999. Proceeding of the National Marine mammal Review Committee Montreal, Quebec. Can. Stock Assess. Sec. Proc. Ser. 1999/14.
- DFO. 2000. Proceedings of the National Marine Mammal Review Committee Harp Seal Review Meeting. Can. Stock. Assess. Sec. Proc. Ser. 2000/05.
- Healey, B.P. and G.B. Stenson. 2000. Estimating pup production and population size of northwest Atlantic harp seal (*Phoca groenlandica*). Can Stock Assess. Sec. Res. Doc. 2000/081.
- Hammill, M. O. and Stenson, G. B. 2007. Application of the Precautionary Approach and conservation reference points to the management of Atlantic seals. ICES Journal of Marine Science, 64: 702-706.
- Hammill, M.O. and Stenson, G.B. 2011. Estimating abundance of Northwest Atlantic harp seals, examining the impact of density dependence. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/011.
- Hammill, M.O. and Stenson, G.B. 2014. Changes in ice conditions and potential impact on harp seal pupping DFO Can. Sci. Advis. Sec. Res. Doc. 2014/025.

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- Hammill, M.O., Stenson, G.B., Doniol-Valcroze, T. and Mosnier, A. 2011. Northwest Atlantic Harp Seals Population Trends, 1952-2012. DFO Can. Sci. Advis. Sec. Res. Doc. 2011/099. iv + 28 p.
- Hammill, M.O., G.B. Stenson, T. Doniol-Valcroze, A. Mosnier. 2012. Estimating carrying capacity and population trends of Northwest Atlantic Harp Seals, 1952-2012. DFO Can. Sci. Advis. Sec. Res. Doc. 2012/148.
- Kapel, F.O. 1999. Age composition in Greenland catches of harp seal. Working Paper. Presented to the national Marine mammal Peer Review Committee, Montreal, Canada, Feb. 1-5, 1999.
- Lavigne, D. M. 1999. Estimating total kill of northwest Atlantic harp seals, 1994-1998. *Mar. Mamm Sci.* 15:871-878.
- Lett, P. F. and T. Benjaminsen. 1977. A stochastic model for the management of the Northwest Atlantic harp seal (*Pagophilus groenlandicus*) population. *J. Fish. Res. Bd. Canada*. 34:1155-1187.
- Lien, J., G.B. Stenson, S. Carver and J. Chardine. 1994. How many did you catch? The effect of methodology on by catch reports obtained from fishermen. *Rep. Int. Whal. Commn. Spec. Issue* 15:535-540.
- North Atlantic Marine Mammal Commission (NAMMCO). 2006. Report of the NAMMCO Workshop to address the problems of "Struck and Lost" in seal, walrus and whale hunting. Copenhagen, Denmark. 14-16 November, 2006.
- Read, A.J. 1994. Interactions between cetaceans and gillnet and trap fisheries in the northwest Atlantic. *Rep. Int. Whal. Commn. Special Issue* 15:133-147.
- Roff, D.A., and W.D. Bowen. 1986. Further analysis of population trends in the Northwest Atlantic harp seal (*Phoca groenlandica*) from 1967 to 1985. *Can. J. Fish. Aquat. Sci.* 43:553-564.
- Rowse, H.C. 1977. Sealing activities by Newfoundland landmen and ships on the Front. Report to the Committee on Seals and Sealing and the Canadian Federation of Humane Societies. 24 p. Available from the Department of Fisheries and Oceans, 200 Kent St. Ottawa, ON K1A 0E6.
- Ryan, S. 1994. The Ice Hunters: A history of Newfoundland Sealing to 1914. St. John's NF, Breakwater Books.
- Sergeant, D. E. 1991. Harp seals, man and ice. *Can. Spec. Publ. Fish. Aquat. Sci.* 114: 153p.
- Shelton, P.A., G.B. Stenson, B. Sjare, and W.G. Warren. 1996. Model estimates of harp seal numbers-at-age for the Northwest Atlantic. *NAFO Sci. Coun. Studies*. 26:1-14.
- Sjare, B. and G.B. Stenson. 2002. Estimating struck and loss rates for harp seals (*Pagophilus groenlandicus*) in the Northwest Atlantic. *Mar. Mamm. Sci.* 18:710-720.
- Sjare, B., G.B. Stenson, and D. Wakeham. 1996. Summary of the catch and catch-at-age data for harp seals in the Northwest Atlantic, 1946-94. *NAFO Sci. Coun. Studies* 26:33-39.
- Sjare, B., D. Walsh, S. Benjamins and G.B. Stenson. 2005. An Update on Harp Seal (*Pagophilus groenlandicus*) By-Catch Estimates in the Newfoundland Lumpfish Fishery. DFO. Can. Sci. Advis. Sec. Res. Doc. 2005/049.
- Stenson, G.B. 2005. Estimates of human induced mortality in Northwest Atlantic harp seals, 1952-2004. DFO Can. Sci. Advis. Sec. Res. Doc. 2005/050.
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- Stenson, G.B. 2008. Recent catches of harp seals (*Pagophilus groenlandicus*) in the Northwest Atlantic. DFO Can. Sci. Advis. Sec. Res. Doc 2008/080.
- Stenson, G.B. 2009. Total Removals of Northwest Atlantic Harp Seals (*Pagophilus groenlandicus*) 1952-2009. DFO Can. Sci. Advis. Sec. Res. Doc. 2009/112.
- Stenson, G.B., B. Sjare, and D. Wakeham. 1999a. Catch-at-Age of Northwest Atlantic Harp Seals. Can. Stock Assess. Sec. Res. Doc 99/105.
- Stenson, G.B., B. Healey, P.A. Shelton and B. Sjare. 1999. Recent trends in the population of Northwest Atlantic harp seals, *Phoca groenlandica*. Can. Stock Assess. Sec. Res. Doc. 99/107. 24p.
- Stenson, G.B., B. Healey, B. Sjare and D. Wakeham. 2000. Catch-at-age of Northwest Atlantic harp seals, 1952-1999. Can. Stock. Assess. Sec. Res. Doc. 2000/079.
- Ugarte, F. and J. Jakobsen. 2006. Struck and lost in the harp seal hunt in Greenland: A questionnaire survey. Report of the NAMMCO Workshop to address the problems of "Struck and Lost" in seal, walrus and whale hunting. Copenhagen, Denmark. 14-16 November, 2006.
- Walsh, D., B. Sjare and G.B. Stenson. 2000. Preliminary estimates of harp seal by-catch in the Newfoundland lumpfish fishery. Can. Stock Assess. Sec. Res. Doc. 2000/078.
- Waring, G.T., R.M. Pace, J.M. Quintal, C.P. Fairfield and K. Maze-Foley. 2005. Draft U.S. Atlantic and Gulf of Mexico marine mammal stock assessments-2004. NOAA Tech. Mem. NMFS-NE.
- Waring, G.T., E. Josephson, C.P., K. Maze-Foley and P.E. Rosel (eds). 2010. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments-2010. NOAA Tech. Mem. NMFS-NE-219.
- Waring, G.T., E. Josephson, C.P., K. Maze-Foley and P.E. Rosel (eds). 2013. U.S. Atlantic and Gulf of Mexico marine mammal stock assessments-2012. NOAA Tech. Mem. NMFS-NE.
- Woodley, T.H. and D.M. Lavigne. 1991. Incidental capture of pinnipeds in commercial fishing gear. Int. Mar. Mamm. Assoc. Tech. Rep. 91-01.

Table 1. Summary of harp seal catches in the Northwest Atlantic, 1952-2013. Estimated values are shaded.

	Front and Gulf			Canadian Arctic			Greenland			Total Northwest Atlantic		
Year	0	1+	All	0	1+	All	0	1+	All	0	1+	All
1952	198,063	109,045	307,108	60	1724	1,784	9,676	6,724	16,400	207,799	117,493	325,292
1953	197,975	74,911	272,886	60	1724	1,784	9,676	6,724	16,400	207,711	83,359	291,070
1954	175,034	89,382	264,416	60	1724	1,784	11,299	7,852	19,150	186,393	98,958	285,350
1955	252,297	81,072	333,369	60	1724	1,784	9,165	6,369	15,534	261,522	89,165	350,687
1956	341,397	48,013	389,410	60	1724	1,784	6,474	4,499	10,973	347,931	54,236	402,167
1957	165,438	80,042	245,480	60	1724	1,784	7,602	5,282	12,884	173,100	87,048	260,148
1958	140,996	156,790	297,786	60	1724	1,784	9,962	6,923	16,885	151,018	165,437	316,455
1959	238,832	81,302	320,134	60	1724	1,784	5,268	3,660	8,928	244,160	86,686	330,846
1960	156,168	121,182	277,350	60	1724	1,784	9,531	6,623	16,154	165,759	129,529	295,288
1961	168,819	19,047	187,866	60	1724	1,784	7,078	4,918	11,996	175,957	25,689	201,646
1962	207,088	112,901	319,989	60	1724	1,784	5,015	3,485	8,500	212,163	118,110	330,273
1963	270,419	71,623	342,042	60	1724	1,784	5,864	4,247	10,111	276,343	77,594	353,937
1964	266,382	75,281	341,663	60	1724	1,784	5,338	3,865	9,203	271,780	80,870	352,650
1965	182,758	51,495	234,253	60	1724	1,784	5,388	3,901	9,289	188,206	57,120	245,326
1966	251,135	72,004	323,139	60	1724	1,784	4,093	2,964	7,057	255,288	76,692	331,980
1967	277,750	56,606	334,356	60	1724	1,784	2,460	1,782	4,242	280,270	60,112	340,382
1968	156,458	36,238	192,696	60	1724	1,784	4,127	2,989	7,116	160,645	40,951	201,596
1969	233,340	55,472	288,812	60	1724	1,784	3,734	2,704	6,438	237,134	59,900	297,034
1970	217,431	40,064	257,495	60	1724	1,784	3,310	2,959	6,269	220,801	44,747	265,548
1971	210,579	20,387	230,966	60	1724	1,784	3,502	2,070	5,572	214,141	24,181	238,322
1972	116,810	13,073	129,883	60	1724	1,784	3,431	2,563	5,994	120,301	17,360	137,661
1973	98,335	25,497	123,832	60	1724	1,784	5,091	4,121	9,212	103,486	31,342	134,828
1974	114,825	32,810	147,635	60	1724	1,784	4,597	2,548	7,145	119,482	37,082	156,564
1975	140,638	33,725	174,363	60	1724	1,784	4,165	2,587	6,752	144,863	38,036	182,899
1976	132,085	32,917	165,002	60	1724	1,784	7,209	4,747	11,956	139,354	39,388	178,742
1977	126,982	28,161	155,143	60	1724	1,784	9,899	2,967	12,866	136,941	32,852	169,793
1978	116,190	45,533	161,723	72	2057	2,129	6,981	9,657	16,638	123,242	57,248	180,490
1979	132,458	28,083	160,541	122	3498	3,620	8,841	8,703	17,545	141,421	40,284	181,706
1980	132,421	37,105	169,526	214	6136	6,350	4,022	11,233	15,255	136,657	54,474	191,131
1981	178,394	23,775	202,169	157	4515	4,672	6,057	16,916	22,974	184,608	45,206	229,815
1982	145,274	21,465	166,739	164	4717	4,881	8,280	18,647	26,927	153,718	44,828	198,547
1983	50,058	7,831	57,889	164	4717	4,881	6,759	18,025	24,785	56,982	30,573	87,555

Year	Front and Gulf			Canadian Arctic			Greenland			Total Northwest Atlantic		
	0	1+	All	0	1+	All	0	1+	All	0	1+	All
1984	23,922	7,622	31,544	164	4717	4,881	3,686	22,142	25,829	27,772	34,481	62,254
1985	13,334	5,701	19,035	164	4717	4,881	2,966	17,819	20,785	16,465	28,236	44,701
1986	21,888	4,046	25,934	164	4717	4,881	3,725	22,374	26,099	25,777	31,137	56,914
1987	36,350	10,446	46,796	164	4717	4,881	5,403	32,456	37,859	41,917	47,619	89,536
1988	66,972	27,074	94,046	164	4717	4,881	5,768	34,647	40,415	72,904	66,438	139,342
1989	56,346	8,958	65,304	164	4717	4,881	6,133	36,838	42,971	62,643	50,513	113,156
1990	34,402	25,760	60,162	164	4717	4,881	6,498	39,029	45,526	41,064	69,506	110,569
1991	42,382	10,206	52,588	164	4717	4,881	6,862	41,220	48,082	49,408	56,143	105,551
1992	43,866	24,802	68,668	164	4717	4,881	7,227	43,411	50,638	51,257	72,930	124,187
1993	16,401	10,602	27,003	164	4717	4,881	8,038	48,281	56,319	24,603	63,600	88,203
1994	25,223	36,156	61,379	164	4717	4,881	8,188	49,185	57,373	33,575	90,058	123,633
1995	34,106	31,661	65,767	164	4717	4,881	8,956	53,793	62,749	43,226	90,171	133,397
1996	184,856	58,050	242,906	164	4717	4,881	10,554	63,393	73,947	195,574	126,160	321,734
1997	220,476	43,734	264,210	84	2,416	2,500	9,821	58,994	68,816	230,381	105,144	335,526
1998	251,403	31,221	282,624	34	966	1,000	11,599	69,673	81,272	263,036	101,860	364,896
1999	237,644	6,908	244,552	17	483	500	13,290	79,827	93,117	250,951	87,218	338,169
2000	85,035	7,020	92,055	13	387	400	14,052	84,406	98,459	99,101	91,813	190,914
2001	214,754	11,739	226,493	20	580	600	12,192	73,235	85,428	226,966	85,554	312,521
2002	297,764	14,603	312,367	34	966	1,000	9,524	57,210	66,735	307,322	72,779	380,102
2003	280,174	9,338	289,512	34	966	1,000	9,441	56,708	66,149	289,648	67,013	356,661
2004	353,553	12,418	365,971	34	966	1,000	10,074	60,511	70,586	363,661	73,896	437,557
2005	323,800	6,029	329,829	34	966	1,000	13,087	78,609	91,696	336,920	85,604	422,525
2006	346,426	8,441	354,867	34	966	1,000	13,160	79,050	92,210	359,620	88,457	448,077
2007	221,488	3,257	224,745	34	966	1,000	11,822	71,014	82,836	233,344	75,237	308,581
2008	217,565	285	217,850	34	966	1,000	11,497	69,059	80,556	229,096	70,310	299,406
2009	76,668	0	76,668	34	966	1,000	10,296	61,846	72,142	86,998	62,812	149,810
2010	68,654	447	69,101	34	966	1,000	12,847	77,167	90,014	81,535	78,580	160,115
2011	40,371	18	40,389	34	966	1,000	10,563	63,450	74,013	50,968	64,434	115,402
2012	71,319	141	71,460	34	966	1,000	11,231	67,462	78,694	82,584	67,603	150,187
2013	90,703	0	90,703	34	966	1,000	11,231	67,462	78,694	101,968	67,462	169,430

Table 2. Proportion age composition of 1+ harp seal catches at the Front and Gulf 1984-2013. N indicates the number of samples used to estimate proportions. Proportions at age used for 2001-13 are the average for the period 1996-2000.

Age Class 1-12

Year	n	1	2	3	4	5	6	7	8	9	10	11	12
1984	222	0.1622	0.3198	0.1486	0.0991	0.0541	0.036	0.0315	0.0135	0.009	0.009	0.018	0.0135
1985	311	0.2508	0.2797	0.1801	0.0836	0.045	0.0322	0.0225	0.0225	0.0096	0.0129	0	0
1986	747	0.2664	0.2182	0.1981	0.0776	0.0361	0.0281	0.0174	0.012	0.0134	0.0067	0.012	0.0107
1987	923	0.1809	0.1679	0.1766	0.1192	0.0585	0.0455	0.026	0.0249	0.0217	0.0173	0.0195	0.0054
1988	591	0.242	0.2386	0.1692	0.1032	0.0508	0.0305	0.0169	0.0186	0.0085	0.0051	0.0034	0.0068
1989	375	0.1627	0.184	0.1467	0.1467	0.1013	0.0533	0.016	0.0107	0.016	0.0053	0.0053	0.0053
1990	278	0.1835	0.1655	0.2086	0.1367	0.0863	0.0432	0.018	0.0036	0.0108	0.0108	0.0144	0.0108
1991	245	0.1796	0.0531	0.102	0.1592	0.151	0.0776	0.0286	0.0163	0.0163	0.0163	0.0327	0.0286
1992	333	0.2673	0.1772	0.0961	0.0931	0.0691	0.0631	0.048	0.018	0.033	0.015	0.012	0.006
1993	684	0.2865	0.1711	0.1155	0.0775	0.0687	0.057	0.038	0.0249	0.0263	0.0132	0.0132	0.0088
1994	607	0.1598	0.1104	0.1318	0.1301	0.0873	0.0675	0.0412	0.0428	0.0297	0.0198	0.0231	0.0115
1995	666	0.2132	0.1547	0.1276	0.0946	0.0991	0.0616	0.0616	0.0255	0.018	0.0105	0.015	0.0105
1996	590	0.2593	0.1881	0.0712	0.0542	0.0475	0.0373	0.0356	0.0237	0.0169	0.0237	0.022	0.0136
1997	592	0.4054	0.1858	0.0625	0.0439	0.0355	0.0287	0.0253	0.0169	0.0118	0.0304	0.022	0.0118
1998	967	0.1944	0.061	0.0641	0.0383	0.0889	0.0765	0.0641	0.0755	0.0527	0.03	0.0445	0.0321
1999	115	0.5304	0.2609	0.0348	0.0087	0.0174	0.0174	0.0087	0.0174	0.0087	0.0174	0.0000	0.0000
2000	498	0.2309	0.1627	0.0241	0.0321	0.0402	0.0522	0.0622	0.0482	0.0482	0.0402	0.0341	0.0281
2001-13	-	0.3403	0.1676	0.0464	0.0308	0.0455	0.0437	0.0401	0.0395	0.0303	0.0295	0.0252	0.0180

Age Class 13-25

Year	13	14	15	16	17	18	19	20	21	22	23	24	25
1984	0	0.009	0.009	0.0045	0.0045	0	0	0.0045	0.0135	0	0.0135	0.009	0.018
1985	0.0032	0.0161	0.0096	0.0032	0	0.0032	0.0064	0.0064	0	0	0	0	0.0129
1986	0.004	0.008	0.008	0.0067	0.0013	0.0107	0.0054	0.0094	0.008	0.0054	0.0067	0.0067	0.0228
1987	0.0076	0.0098	0.0119	0.0087	0.0065	0.0054	0.0076	0.0098	0.0054	0.0022	0.0076	0.0065	0.0477
1988	0.0102	0.0051	0.0102	0.0085	0.0068	0.0068	0.0102	0.0118	0	0	0.0017	0.0085	0.0271
1989	0.016	0.008	0.0107	0.0107	0.008	0.0133	0.0053	0.0133	0.0107	0.0187	0.0107	0.008	0.0133
1990	0.0144	0.0036	0.0036	0.0072	0.0036	0.0108	0	0.0144	0	0.0072	0.0108	0	0.0324
1991	0.0286	0.0122	0.0204	0.0041	0.0122	0.0122	0.0082	0.0041	0	0.0041	0	0.0041	0.0286
1992	0.006	0.006	0.003	0.012	0.015	0.009	0.018	0.003	0.003	0	0.006	0.003	0.018
1993	0.0161	0.0044	0.0029	0.0044	0.0058	0.0044	0.0058	0	0.0102	0.0044	0.0029	0.0044	0.0336
1994	0.0165	0.0165	0.0181	0.0082	0.0148	0.0132	0.0082	0.0033	0.0082	0.0066	0.0049	0.0082	0.0181
1995	0.006	0.015	0.015	0.0075	0.009	0.012	0.006	0.009	0.009	0.0015	0.006	0.0015	0.0105
1996	0.0136	0.0169	0.0169	0.0254	0.0254	0.0153	0.0102	0.0102	0.0102	0.0136	0.0085	0.0102	0.0305
1997	0.0186	0.0068	0.0084	0.0118	0.0135	0.0101	0.0068	0.0118	0.0068	0.0051	0.0034	0.0051	0.0118
1998	0.0207	0.0217	0.0155	0.0259	0.0134	0.0165	0.0083	0.0124	0.0114	0.0062	0.0041	0.0062	0.0155
1999	0.0261	0.0000	0.0174	0.0000	0.0174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0087	0.0087	0.0000
2000	0.0321	0.0241	0.0161	0.0301	0.0141	0.0161	0.0080	0.0201	0.0060	0.0000	0.0020	0.0080	0.0201
2001-13	0.0244	0.0131	0.0143	0.0170	0.0146	0.0107	0.0058	0.0111	0.0061	0.0028	0.0046	0.0070	0.0118

Table 3. Estimated age compositions of harp seal catches at the Front and Gulf, 1952-2013.

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL
1952	198,063	5,340	11,758	7,779	5,994	6,856	11,645	8,088	7,914	5,754	6,578	5,618	1,785	1,478	2,182	4,091	1,421	2,233	1,798	984	5,391	873	1	435	1,306	1,743	307,108
1953	197,975	20,602	6,330	5,753	3,744	4,037	3,223	2,825	2,882	2,777	2,330	2,851	1,743	1,370	1,022	1,823	1,989	1,408	906	673	2,541	1,664	937	624	453	404	272,886
1954	175,034	31,645	12,587	3,949	5,625	2,934	3,709	3,329	3,036	2,011	2,908	1,250	2,623	2,533	1,316	1,832	2,196	1,017	337	1,121	831	307	284	718	142	1,142	264,416
1955	252,297	21,800	8,498	6,001	4,321	3,989	3,652	3,113	3,271	2,598	2,942	2,618	2,035	1,555	1,163	2,222	2,080	1,364	739	768	2,374	1,303	779	616	515	756	333,369
1956	341,397	12,068	4,795	3,299	2,629	2,194	2,127	1,909	2,041	1,748	1,838	1,587	1,315	998	848	1,331	1,321	870	578	571	1,505	739	459	389	346	508	389,410
1957	165,438	21,656	7,982	5,330	4,275	3,586	3,464	3,068	3,128	2,684	2,990	2,762	2,080	1,713	1,316	2,309	2,171	1,422	780	826	2,418	1,300	795	611	535	841	245,480
1958	140,996	24,328	9,817	11,311	11,855	10,092	6,589	6,063	5,092	4,813	9,670	5,745	7,088	4,169	3,148	8,813	5,846	2,987	560	1,498	5,374	2,899	2,426	1,007	1,966	3,634	297,786
1959	238,832	21,882	8,185	5,458	4,239	3,788	3,741	3,232	3,247	2,830	3,110	2,695	2,054	1,653	1,280	2,347	2,149	1,422	741	819	2,411	1,299	773	633	526	788	320,134
1960	156,168	32,554	12,672	9,520	6,539	5,561	5,571	4,631	4,505	3,860	4,404	3,896	3,005	2,395	1,784	3,339	3,164	2,046	1,084	1,145	3,568	1,924	1,155	916	779	1,165	277,350
1961	168,819	5,035	1,977	1,951	2,399	810	1,014	1,009	617	586	909	542	310	313	306	154	248	189	99	120	146	0	80	59	9	165	187,866
1962	207,088	29,503	33,876	9,411	8,724	6,173	2,677	2,488	2,568	2,534	1,083	1,242	1,872	966	1,349	1,911	660	1,663	763	578	1,291	159	604	29	152	625	319,989
1963	270,419	9,018	8,102	6,615	3,842	3,014	3,441	3,410	3,360	3,096	3,587	3,450	2,546	2,751	2,770	2,145	2,625	1,794	1,176	924	944	848	628	493	412	632	342,042
1964	266,382	5,685	5,253	5,699	6,561	4,333	6,511	3,375	2,789	2,635	4,106	2,142	2,132	1,643	1,629	2,491	2,014	2,502	3,857	2,010	62	1,953	987	983	1,438	2,491	341,663
1965	182,758	11,710	5,382	4,621	4,901	5,968	5,537	2,094	969	642	1,231	389	1,644	263	1,195	1,029	546	310	671	715	246	464	228	20	29	691	234,253
1966	251,135	13,528	10,652	4,901	4,791	4,987	5,020	4,564	3,091	1,630	1,706	2,224	1,606	1,455	1,631	1,370	1,376	967	1,511	933	1,000	724	299	631	351	1,056	323,139
1967	277,750	14,120	6,348	2,552	2,204	3,117	3,956	3,422	2,406	1,567	1,401	1,790	1,245	984	1,472	1,487	965	1,230	1,344	1,385	898	584	426	482	291	930	334,356
1968	156,458	5,747	4,194	2,800	1,653	1,471	1,504	2,130	2,231	1,524	1,529	1,149	913	854	1,115	950	885	756	1,100	950	677	417	573	299	219	598	192,696
1969	233,340	21,117	2,815	2,859	2,353	2,660	1,963	2,261	2,816	2,056	1,732	1,532	1,013	1,162	1,183	1,229	784	1,265	809	913	757	548	336	411	191	707	288,812
1970	217,431	8,766	7,386	2,580	2,429	2,363	1,363	1,326	1,601	1,437	1,813	1,183	1,129	830	723	866	937	541	538	549	484	350	263	202	133	272	257,495
1971	210,579	7,692	2,568	2,092	1,055	1,047	644	515	446	672	728	464	491	375	168	226	198	139	151	138	90	60	74	46	9	299	230,966
1972	116,810	4,100	2,269	1,319	1,276	601	531	377	309	159	216	248	251	133	211	172	100	121	139	64	195	108	72	45	33	24	129,883
1973	98,335	4,918	3,918	2,755	2,284	3,159	1,051	908	1,023	636	603	725	582	564	415	439	347	211	159	175	180	40	145	18	18	224	123,832
1974	114,825	10,412	5,762	2,137	1,725	1,800	2,671	797	914	1,047	706	492	639	641	445	395	427	371	254	198	103	113	140	76	114	431	147,635
1975	140,638	12,776	6,170	3,106	1,661	1,574	1,437	1,379	787	573	804	505	509	486	346	251	297	215	214	190	86	105	63	68	71	52	174,363
1976	132,085	14,575	7,084	3,923	2,598	888	593	530	544	227	324	315	258	142	179	219	93	105	67	59	64	18	25	41	23	23	165,002
1977	126,982	7,451	5,581	5,131	3,746	1,906	1,062	727	455	192	219	219	154	186	360	385	166	27	38	12	30	15	20	37	22	20	155,143
1978	116,190	15,853	10,031	6,051	4,438	2,963	1,967	647	859	337	578	198	206	222	137	205	109	104	138	70	111	91	79	33	21	85	161,723
1979	132,458	13,686	5,814	2,700	1,668	1,272	789	425	231	217	73	73	79	75	148	153	34	56	55	40	21	21	30	10	11	402	160,541
1980	132,421	14,132	6,565	4,378	2,573	1,994	1,597	1,104	790	555	269	432	413	299	380	345	321	262	27	97	147	81	73	16	10	245	169,526
1981	178,394	5,633	3,077	2,906	2,745	2,421	1,700	1,028	706	295	428	440	310	228	218	221	206	272	183	147	51	166	169	63	29	133	202,169
1982	145,274	7,832	4,229	2,263	1,285	1,428	626	901	363	439	176	297	110	154	99	154	66	198	55	121	121	154	22	77	44	253	166,739
1983	50,058	2,754	1,430	839	447	545	437	275	216	99	135	64	69	33	56	100	48	36	69	40	33	13	3	25	14	51	57,889
1984	23,922	1,236	2,438	1,133	755	412	274	240	103	69	69	137	103	0	69	69	34	34	0	0	34	103	0	103	69	137	31,542
1985	13,334	1,430	1,595	1,027	477	257	184	128	128	55	74	0	0	18	92	55	18	0	18	36	36	0	0	0	0	74	19,034

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL
1986	21,888	1,078	883	802	314	146	114	70	49	54	27	49	43	16	32	32	27	5	43	22	38	32	22	27	27	92	25,934
1987	36,350	1,889	1,754	1,845	1,245	611	475	272	260	227	181	204	56	79	102	124	91	68	56	79	102	56	23	79	68	498	46,796
1988	66,972	6,549	6,457	4,579	2,793	1,375	825	457	503	230	138	92	184	276	138	276	230	184	184	276	319	0	0	46	230	733	94,046
1989	56,346	1,457	1,648	1,314	1,314	907	477	143	96	143	47	47	47	143	72	96	96	72	119	47	119	96	168	96	72	119	65,304
1990	34,402	4,726	4,262	5,372	3,521	2,223	1,113	464	93	278	278	371	278	371	93	93	185	93	278	0	371	0	185	278	0	834	60,162
1991	42,382	1,833	542	1,041	1,625	1,541	792	292	166	166	166	334	292	292	125	208	42	125	125	84	42	0	42	0	42	292	52,589
1992	43,866	6,630	4,395	2,383	2,309	1,714	1,565	1,190	446	818	372	298	149	149	149	74	298	372	223	446	74	74	0	149	74	446	68,666
1993	16,401	3,037	1,814	1,225	822	728	604	403	264	279	140	140	93	171	47	31	47	61	47	61	0	108	47	31	47	356	27,003
1994	25,223	5,779	3,992	4,766	4,705	3,157	2,441	1,490	1,548	1,074	716	835	416	597	597	655	297	535	477	297	119	297	239	177	297	655	61,379
1995	34,106	6,751	4,898	4,040	2,995	3,138	1,951	1,951	807	570	332	475	332	190	475	475	237	285	380	190	285	285	47	190	47	332	65,767
1996	184,856	15,052	10,919	4,133	3,146	2,757	2,165	2,067	1,376	981	1,376	1,277	789	789	981	981	1,474	1,474	888	592	592	592	789	493	592	1,771	242,906
1997	220,476	17,730	8,126	2,733	1,920	1,553	1,255	1,106	739	516	1,330	962	516	813	297	367	516	590	442	297	516	297	223	149	223	516	264,210
1998	251,403	6,070	1,905	2,001	1,196	2,776	2,389	2,001	2,357	1,646	937	1,389	1,002	646	678	484	809	418	515	259	387	356	194	128	194	484	282,624
1999	237,644	3,664	1,802	240	60	120	120	60	120	60	120	0	0	180	0	120	0	120	0	0	0	0	0	60	60	0	244,552
2000	85,035	1,621	1,142	169	226	282	367	437	338	338	282	240	197	226	169	113	211	99	113	56	141	42	0	14	56	141	92,055
2001	214,754	3,995	1,967	544	361	534	513	471	464	356	346	295	211	286	154	168	199	171	125	68	130	71	33	53	82	139	226,493
2002	297,764	4,969	2,447	677	449	664	638	585	577	443	431	367	263	356	192	209	248	213	156	84	162	88	41	66	102	173	312,367
2003	280,174	3,178	1,565	433	287	425	408	374	369	283	275	235	168	228	123	134	158	136	100	54	103	57	26	42	65	111	289,512
2004	353,553	4,226	2,081	576	382	565	543	498	490	377	366	312	224	303	163	178	211	181	132	72	137	75	35	57	87	147	365,971
2005	323,800	2,052	1,010	280	185	274	263	242	238	183	178	152	109	147	79	86	102	88	64	35	67	37	17	27	42	71	329,829
2006	346,426	2,872	1,415	391	260	384	369	338	333	256	249	212	152	206	111	121	143	123	90	49	93	51	24	38	59	100	354,867
2007	221,488	1,108	546	151	100	148	142	131	129	99	96	82	59	79	43	47	55	48	35	19	36	20	9	15	23	39	224,745
2008	217,565	97	48	13	9	13	12	11	11	9	8	7	5	7	4	4	5	4	3	2	3	2	1	1	2	3	217,850
2009	76,668	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	76,668
2010	68,654	152	75	21	14	20	20	18	18	14	13	11	8	11	6	6	8	7	5	3	5	3	1	2	3	5	69,101
2011	40,371	6	3	1	1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	40,389
2012	71,319	48	24	7	4	6	6	6	6	4	4	4	3	3	2	2	2	2	2	1	2	1	0	1	1	2	71,460
2013	90,703	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	90,703

Table 4. Proportional age composition of harp seal catches in Greenland (from Bowen 1982 and Kapel 1999).

Age class 1-12

Year	0	1	2	3	4	5	6	7	8	9	10	11	12
1954-62	0.590	0.160	0.050	0.040	0.030	0.020	0.020	0.010	0.010	0.010	0.010	0.005	0.005
1963-69	0.580	0.110	0.070	0.040	0.030	0.030	0.020	0.020	0.010	0.010	0.010	0.007	0.008
1970	0.528	0.064	0.040	0.056	0.032	0.040	0.024	0.032	0.016	0.024	0.024	0.024	0.008
1971	0.629	0.097	0.046	0.069	0.023	0.011	0.011	0.006	0.006	0.017	0.006	0.017	0.011
1972	0.572	0.123	0.080	0.038	0.050	0.024	0.018	0.021	0.004	0.000	0.004	0.003	0.007
1973	0.553	0.216	0.079	0.038	0.011	0.020	0.006	0.005	0.007	0.001	0.005	0.004	0.006
1974	0.643	0.189	0.073	0.007	0.017	0.005	0.010	0.003	0.003	0.002	0.000	0.005	0.007
1975	0.617	0.231	0.071	0.023	0.016	0.003	0.000	0.003	0.003	0.006	0.003	0.003	0.006
1976	0.603	0.223	0.092	0.037	0.017	0.002	0.000	0.000	0.002	0.000	0.002	0.000	0.002
1977	0.769	0.118	0.049	0.019	0.013	0.004	0.001	0.004	0.002	0.001	0.002	0.003	0.003
1978	0.420	0.297	0.109	0.065	0.022	0.018	0.020	0.002	0.008	0.003	0.003	0.003	0.004
1979	0.504	0.201	0.123	0.058	0.024	0.012	0.014	0.009	0.007	0.005	0.003	0.001	0.002
1980	0.264	0.345	0.152	0.095	0.041	0.022	0.013	0.007	0.009	0.005	0.003	0.005	0.003
1981	0.264	0.345	0.152	0.095	0.041	0.022	0.013	0.007	0.009	0.005	0.003	0.005	0.003
1982	0.308	0.275	0.160	0.093	0.043	0.023	0.015	0.008	0.010	0.018	0.013	0.008	0.003
1983	0.273	0.292	0.127	0.094	0.073	0.025	0.025	0.022	0.006	0.013	0.009	0.007	0.006
1984-2013	0.143	0.177	0.150	0.146	0.083	0.058	0.044	0.033	0.028	0.012	0.011	0.011	0.004

Age class 13-25 +

Year	13	14	15	16	17	18	19	20	21	22	23	24	25+
1954-62	0.003	0.004	0.007	0.003	0.004	0.003	0.003	0.004	0.002	0.002	0.002	0.002	0.002
1963-69	0.004	0.005	0.010	0.004	0.005	0.004	0.004	0.006	0.003	0.002	0.002	0.002	0.003
1970	0.016	0.008	0.000	0.000	0.000	0.000	0.000	0.016	0.008	0.008	0.008	0.008	0.016
1971	0.000	0.017	0.006	0.000	0.006	0.006	0.000	0.000	0.006	0.006	0.000	0.000	0.006
1972	0.003	0.001	0.004	0.003	0.001	0.006	0.004	0.003	0.003	0.003	0.003	0.003	0.016
1973	0.006	0.002	0.000	0.007	0.005	0.004	0.004	0.005	0.002	0.002	0.002	0.002	0.005
1974	0.003	0.007	0.002	0.005	0.003	0.000	0.005	0.003	0.002	0.002	0.002	0.002	0.002
1975	0.000	0.003	0.003	0.000	0.000	0.000	0.000	0.003	0.003	0.000	0.000	0.000	0.000
1976	0.002	0.002	0.002	0.005	0.002	0.000	0.000	0.000	0.002	0.000	0.000	0.000	0.000
1977	0.001	0.000	0.000	0.002	0.002	0.000	0.000	0.000	0.001	0.001	0.000	0.000	0.002
1978	0.003	0.003	0.002	0.002	0.001	0.000	0.000	0.000	0.001	0.001	0.001	0.000	0.008
1979	0.001	0.003	0.001	0.004	0.004	0.001	0.003	0.002	0.004	0.003	0.003	0.002	0.005
1980	0.003	0.001	0.003	0.002	0.000	0.001	0.003	0.003	0.002	0.002	0.002	0.002	0.011
1981	0.003	0.001	0.003	0.002	0.000	0.001	0.003	0.003	0.002	0.002	0.002	0.002	0.011
1982	0.005	0.000	0.003	0.003	0.000	0.003	0.003	0.003	0.003	0.003	0.003	0.000	0.003
1983	0.003	0.001	0.003	0.004	0.004	0.001	0.003	0.001	0.001	0.000	0.000	0.000	0.003
1984-2013	0.009	0.005	0.010	0.009	0.008	0.009	0.007	0.009	0.007	0.007	0.006	0.005	0.007

Table 5. Estimated age compositions of harp seal catches in Greenland, 1952-2013.

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL
1952	9,676	2,624	820	656	492	328	328	164	164	164	164	85	88	53	62	113	53	59	43	47	71	34	28	25	28	31	16,400
1953	9,676	2,624	820	656	492	328	328	164	164	164	164	85	88	53	62	113	53	59	43	47	71	34	28	25	28	31	16,400
1954	11,299	3,064	958	766	575	383	383	192	192	192	192	100	103	62	72	132	62	69	51	54	83	40	33	29	33	36	19,150
1955	9,165	2,485	777	621	466	311	311	155	155	155	155	81	84	50	59	107	50	56	41	44	68	32	26	23	26	29	15,534
1956	6,474	1,756	549	439	329	219	219	110	110	110	110	57	59	35	41	76	35	39	29	31	48	23	19	17	19	21	10,973
1957	7,602	2,061	644	515	387	258	258	129	129	129	129	67	69	41	49	89	41	46	34	37	56	27	22	19	22	24	12,884
1958	9,962	2,702	844	675	507	338	338	169	169	169	169	88	91	54	64	117	54	61	45	48	73	35	29	26	29	32	16,885
1959	5,268	1,428	446	357	268	179	179	89	89	89	89	46	48	29	34	62	29	32	24	25	39	19	15	14	15	17	8,928
1960	9,531	2,585	808	646	485	323	323	162	162	162	162	84	87	52	61	111	52	58	43	46	70	34	27	24	27	31	16,154
1961	7,078	1,919	600	480	360	240	240	120	120	120	120	62	65	39	45	83	39	43	32	34	52	25	20	18	20	23	11,996
1962	5,015	1,360	425	340	255	170	170	85	85	85	85	44	46	27	32	59	27	31	22	24	37	18	14	13	14	16	8,500
1963	5,864	1,112	708	404	303	303	202	202	101	101	101	74	76	45	54	98	45	51	37	40	62	29	24	21	24	27	10,111
1964	5,338	1,012	644	368	276	276	184	184	92	92	92	67	69	41	49	89	41	46	34	37	56	27	22	19	22	24	9,203
1965	5,388	1,022	650	372	279	279	186	186	93	93	93	68	70	42	49	90	42	47	34	37	57	27	22	20	22	25	9,289
1966	4,093	776	494	282	212	212	141	141	71	71	71	51	53	32	37	68	32	35	26	28	43	21	17	15	17	19	7,057
1967	2,460	467	297	170	127	127	85	85	42	42	42	31	32	19	22	41	19	21	16	17	26	12	10	9	10	11	4,242
1968	4,127	783	498	285	213	213	142	142	71	71	71	52	54	32	38	69	32	36	26	28	43	21	17	15	17	19	7,116
1969	3,734	708	451	258	193	193	129	129	64	64	64	47	49	29	34	62	29	32	24	26	39	19	15	14	15	17	6,438
1970	3,310	401	251	351	201	251	150	201	100	150	150	150	50	100	50	0	0	0	0	0	100	50	50	50	50	100	6,269
1971	3,502	541	255	382	127	64	64	32	32	96	32	96	64	0	96	32	0	32	32	0	0	32	32	0	0	32	5,572
1972	3,431	736	479	231	301	142	106	124	27	0	27	18	44	18	9	27	18	9	35	27	18	18	18	18	18	98	5,994
1973	5,091	1,986	731	354	103	183	57	46	68	11	46	34	57	57	23	0	68	46	34	34	46	23	23	23	23	46	9,212
1974	4,597	1,351	521	47	118	36	71	24	24	12	0	36	47	24	47	12	36	24	0	36	24	12	12	12	12	12	7,145
1975	4,165	1,556	482	153	110	22	0	22	22	44	22	22	44	0	22	22	0	0	0	0	22	22	0	0	0	0	6,752
1976	7,209	2,670	1,098	445	208	30	0	0	30	0	30	0	30	30	30	30	59	30	0	0	0	30	0	0	0	0	11,956
1977	9,899	1,512	628	242	171	57	14	57	29	14	29	43	43	14	0	0	29	29	0	0	0	14	14	0	0	29	12,866
1978	6,981	4,941	1,815	1,085	374	299	337	37	131	56	56	56	75	56	56	37	37	19	0	0	0	19	19	19	0	131	16,638
1979	8,842	3,534	2,163	1,019	428	214	239	151	126	88	50	25	38	25	50	25	63	63	25	50	38	63	50	50	38	88	17,545
1980	4,022	5,256	2,324	1,442	625	337	192	112	144	80	48	80	48	48	16	48	32	0	16	48	48	32	32	32	32	160	15,255
1981	6,057	7,915	3,499	2,172	941	507	290	169	217	121	72	121	72	72	24	72	48	0	24	72	72	48	48	48	48	241	22,974
1982	8,280	7,405	4,308	2,491	1,144	606	404	202	269	471	337	202	67	135	0	67	67	0	67	67	67	67	67	67	0	67	26,927
1983	6,760	7,240	3,140	2,327	1,810	628	628	554	148	332	222	185	148	74	37	74	111	111	37	74	37	37	0	0	0	74	24,785
1984	3,686	4,578	3,869	3,780	2,150	1,487	1,125	850	732	308	293	291	115	228	128	261	242	211	227	193	224	193	177	160	128	192	25,829
1985	2,966	3,684	3,113	3,042	1,730	1,197	905	684	589	248	236	235	92	183	103	210	194	170	182	156	180	156	142	129	103	154	20,785

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL
1986	3,725	4,626	3,909	3,819	2,173	1,503	1,137	859	740	311	296	294	116	230	130	264	244	214	229	195	226	195	179	162	130	194	26,099
1987	5,403	6,711	5,671	5,540	3,151	2,180	1,649	1,246	1,073	452	429	427	168	334	188	383	354	310	332	283	328	283	259	235	188	281	37,859
1988	5,768	7,164	6,054	5,914	3,364	2,327	1,760	1,330	1,146	482	458	456	180	357	201	409	378	331	354	302	350	302	277	251	201	300	40,415
1989	6,133	7,617	6,437	6,288	3,577	2,474	1,871	1,414	1,218	512	487	485	191	379	214	435	402	352	377	322	372	322	294	266	214	319	42,971
1990	6,498	8,070	6,819	6,662	3,790	2,621	1,983	1,498	1,291	543	516	514	202	402	226	460	426	373	399	341	394	341	311	282	226	338	45,526
1991	6,862	8,523	7,202	7,036	4,002	2,768	2,094	1,582	1,363	573	545	543	214	424	239	486	450	394	422	360	416	360	329	298	239	357	48,082
1992	7,227	8,976	7,585	7,410	4,215	2,915	2,205	1,666	1,436	604	574	571	225	447	252	512	474	414	444	379	438	379	346	314	252	376	50,638
1993	8,038	9,983	8,436	8,241	4,688	3,242	2,453	1,853	1,597	672	639	635	250	497	280	570	527	461	494	422	488	422	385	349	280	418	56,319
1994	8,188	10,170	8,594	8,396	4,776	3,303	2,499	1,888	1,627	684	651	647	255	506	285	580	537	470	503	429	497	429	393	356	285	426	57,373
1995	8,956	11,123	9,399	9,182	5,223	3,613	2,733	2,065	1,779	748	712	708	279	554	312	637	587	514	550	470	543	470	429	389	312	466	62,749
1996	10,554	13,107	11,077	10,821	6,155	4,257	3,220	2,433	2,097	882	839	834	328	653	368	748	692	605	649	553	640	553	506	458	368	549	73,947
1997	9,821	12,198	10,308	10,070	5,728	3,962	2,997	2,265	1,951	821	780	777	306	607	342	696	644	563	604	515	596	515	471	427	342	511	68,816
1998	11,599	14,406	12,174	11,893	6,765	4,679	3,539	2,674	2,304	969	922	917	361	717	404	822	760	665	713	608	704	608	556	504	404	604	81,272
1999	13,290	16,505	13,948	13,626	7,751	5,361	4,055	3,064	2,640	1,111	1,056	1,051	414	822	463	942	871	762	817	697	806	697	637	577	463	692	93,117
2000	14,052	17,452	14,748	14,408	8,196	5,669	4,288	3,240	2,791	1,174	1,117	1,111	437	869	489	996	921	806	863	737	852	737	674	610	489	731	98,459
2001	12,192	15,142	12,796	12,501	7,111	4,918	3,720	2,811	2,422	1,019	969	964	379	754	425	864	799	699	749	639	739	639	584	530	425	635	85,428
2002	9,524	11,829	9,996	9,765	5,555	3,842	2,906	2,196	1,892	796	757	753	296	589	332	675	624	546	585	499	578	499	457	414	332	496	66,735
2003	9,441	11,725	9,908	9,680	5,506	3,808	2,881	2,177	1,875	789	750	746	294	584	329	669	619	541	580	495	573	495	453	410	329	491	66,149
2004	10,074	12,512	10,573	10,329	5,876	4,064	3,074	2,323	2,001	842	800	796	314	623	351	714	660	578	619	528	611	528	483	438	351	524	70,586
2005	13,087	16,253	13,735	13,418	7,633	5,279	3,993	3,017	2,600	1,094	1,040	1,035	407	809	456	927	858	750	804	686	794	686	627	568	456	681	91,696
2006	13,160	16,345	13,812	13,493	7,676	5,309	4,016	3,034	2,614	1,100	1,046	1,040	410	814	458	932	863	755	809	690	798	690	631	572	458	685	92,210
2007	11,822	14,683	12,408	12,122	6,895	4,769	3,607	2,726	2,349	988	939	935	368	731	412	838	775	678	726	620	717	620	567	514	412	615	82,836
2008	11,497	14,279	12,067	11,788	6,706	4,638	3,508	2,651	2,284	961	914	909	358	711	400	815	754	659	706	603	697	603	551	499	400	598	80,556
2009	10,296	12,788	10,806	10,557	6,005	4,153	3,142	2,374	2,045	860	818	814	320	637	359	730	675	590	633	540	624	540	494	447	359	536	72,142
2010	12,847	15,955	13,483	13,172	7,493	5,182	3,920	2,962	2,552	1,074	1,021	1,016	400	795	447	910	842	737	789	674	779	674	616	558	447	669	90,014
2011	10,563	13,119	11,086	10,830	6,161	4,261	3,223	2,436	2,098	883	839	835	329	653	368	748	692	606	649	554	641	554	506	459	368	550	74,013
2012	11,231	13,949	11,788	11,515	6,551	4,531	3,427	2,590	2,231	939	892	888	350	695	391	796	736	644	690	589	681	589	538	488	391	585	78,694
2013	11,231	13,949	11,788	11,515	6,551	4,531	3,427	2,590	2,231	939	892	888	350	695	391	796	736	644	690	589	681	589	538	488	391	585	78,694

Table 6. Proportional age composition of harp seal catches in the Canadian Arctic (from Bowen 1982).

0	1	2	3	4	5	6	7	8	9	10	11	12
0.034	0.066	0.119	0.132	0.090	0.053	0.049	0.052	0.038	0.027	0.044	0.031	0.032
13	14	15	16	17	18	19	20	21	22	23	24	25+
0.019	0.022	0.041	0.019	0.021	0.016	0.017	0.026	0.012	0.010	0.009	0.010	0.011

Table 7. Estimated age compositions of harp seal catches in the Canadian Arctic, 1952-2013.

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL
1952	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1953	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1954	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1955	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1956	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1957	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1958	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1959	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1960	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1961	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1962	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1963	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1964	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1965	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1966	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1967	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1968	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1969	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1970	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1971	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1972	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1973	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1974	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1975	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1976	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1977	60	117	212	236	160	95	87	93	67	49	79	55	57	34	40	73	34	38	28	30	46	22	18	16	18	20	1,784
1978	72	140	253	282	191	113	104	111	80	58	94	66	68	41	48	87	41	45	33	36	55	26	21	19	21	24	2,129
1979	122	237	430	479	325	193	177	189	136	99	160	112	116	69	81	148	69	77	57	61	93	45	37	32	37	41	3,620
1980	214	416	755	840	570	338	310	331	238	174	281	196	203	121	142	260	121	135	100	107	164	78	64	57	64	71	6,350
1981	157	306	555	618	419	249	228	244	175	128	207	144	149	89	105	191	89	100	73	79	120	58	47	42	47	52	4,672
1982	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1983	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1984	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1985	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1986	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1987	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1988	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1989	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1990	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1991	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1992	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1993	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1994	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1995	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1996	164	320	580	646	438	260	238	255	183	134	216	150	156	93	109	200	93	104	77	82	126	60	49	44	49	55	4,881
1997	61	118	214	239	162	96	88	94	68	50	80	56	58	34	40	74	34	38	28	30	47	22	18	16	18	20	1,804
1998	24	47	85	95	64	38	35	37	27	20	32	22	23	14	16	29	14	15	11	12	19	9	7	6	7	8	719
1999	12	24	44	49	33	20	18	19	14	10	16	11	12	7	8	15	7	8	6	6	9	5	4	3	4	4	368
2000	9	18	33	37	25	15	14	15	11	8	12	9	9	5	6	11	5	6	4	5	7	3	3	3	3	3	280
2001	14	27	48	54	36	22	20	21	15	11	18	12	13	8	9	17	8	9	6	7	10	5	4	4	4	5	405
2002-13	34	66	119	132	90	53	49	52	38	27	44	31	32	19	22	41	19	21	16	17	26	12	10	9	10	11	1,000

Table 8. Proportion of seals recovered (and reported) for young of the year (0) and older (1 +) animals.

	Harvest Area			
	Front & Gulf		Canadian Arctic & Greenland	
	0	1+	0	1+
1952-1982	0.99	0.50	0.50	0.50
1983-2013	0.95	0.50	0.50	0.50

Table 9. Estimated by-catch of harp seals in commercial fisheries. Catches in the Newfoundland lumpfish fishery are from Sjare et al. (2005) while catches in the United States waters are from Waring et al. (2005, 2010, 2012).

Year	Lumpfish By-catch (0)	Lumpfish By-catch (1+)	Lumpfish By-catch Total	US By-catch	Totals
1970	53	15	68	-	68
1971	391	99	490	-	490
1972	480	141	621	-	621
1973	358	107	465	-	465
1974	141	41	182	-	182
1975	219	66	285	-	285
1976	923	169	1,092	-	1,092
1977	1,281	296	1,577	-	1,577
1978	2,381	538	2,919	-	2,919
1979	2,799	511	3,310	-	3,310
1980	2,454	263	2,717	-	2,717
1981	3,539	382	3,921	-	3,921
1982	3,442	343	3,785	-	3,785
1983	4,504	458	4,962	-	4,962
1984	3,683	425	4,108	-	4,108
1985	4,225	632	4,857	-	4,857
1986	7,136	1,042	8,178	-	8,178
1987	11,118	1,978	13,096	-	13,096
1988	7,154	1,391	8,545	-	8,545
1989	9,457	799	10,256	-	10,256
1990	2,700	921	3,621	-	3,621
1991	9,074	615	9,689	-	9,689
1992	18,969	6,507	25,476	-	25,476
1993	18,876	7,596	26,472	-	26,472
1994	35,881	10,513	46,394	861	47,255
1995	13,641	6,060	19,701	694	20,395
1996	10,765	18,347	29,112	89	29,201
1997	13,541	5,059	18,600	269	18,869
1998	3,571	975	4,546	95	4,641
1999	9,750	6,280	16,030	81	16,111
2000	9,715	1,608	11,323	24	11,347
2001	14,572	4,828	19,400	75	19,475
2002	5,492	3,837	9,329	0	9,329
2003	3,486	1,881	5,367	0	5,367
2004	8,494	3,796	12,290	303	12,593
2005	8,494	3,796	12,290	35	12,325
2006	8,494	3,796	12,290	65	12,355
2007	8,494	3,796	12,290	157	12,447
2008	8,494	3,796	12,290	414	12,704
2009	8,494	3,796	12,290	485	12,775
2010	8,494	3,796	12,290	285	12,575
2011-13	8,494	3,796	12,290	281	12,571

Table 10. Estimated age compositions of harp seals taken as incidental catches in Canadian and US commercial fisheries 1952-2013.

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL	
1970	53	3	3	1	1	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	68	
1971	391	37	12	10	5	5	3	3	2	3	4	2	2	2	1	1	1	1	1	1	0	0	0	0	0	0	1	490
1972	480	44	24	14	14	6	6	4	3	2	2	3	3	1	2	2	1	1	1	1	2	1	1	0	0	0	621	
1973	358	21	16	12	10	13	4	4	4	3	3	3	2	2	2	2	1	1	1	1	1	0	1	0	0	1	465	
1974	141	13	7	3	2	2	3	1	1	1	1	1	1	1	1	0	1	0	0	0	0	0	0	0	0	1	182	
1975	219	25	12	6	3	3	3	3	2	1	2	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	285	
1976	923	75	36	20	13	5	3	3	3	1	2	2	1	1	1	1	0	1	0	0	0	0	0	0	0	0	1,092	
1977	1,281	78	59	54	39	20	11	8	5	2	2	2	2	2	4	4	2	0	0	0	0	0	0	0	0	0	1,577	
1978	2,381	187	119	71	52	35	23	8	10	4	7	2	2	3	2	2	1	1	2	1	1	1	1	0	0	1	2,919	
1979	2,799	249	106	49	30	23	14	8	4	4	1	1	1	1	3	3	1	1	1	1	0	0	1	0	0	7	3,310	
1980	2,454	100	47	31	18	14	11	8	6	4	2	3	3	2	3	2	2	2	0	1	1	1	1	0	0	2	2,717	
1981	3,539	91	49	47	44	39	27	17	11	5	7	7	5	4	4	4	3	4	3	2	1	3	3	1	0	2	3,921	
1982	3,442	125	68	36	21	23	10	14	6	7	3	5	2	2	2	2	1	3	1	2	2	2	0	1	1	4	3,785	
1983	4,504	161	84	49	26	32	26	16	13	6	8	4	4	2	3	6	3	2	4	2	2	1	0	1	1	3	4,962	
1984	3,683	69	136	63	42	23	15	13	6	4	4	8	6	0	4	4	2	2	0	0	2	6	0	6	4	8	4,108	
1985	4,225	159	177	114	53	28	20	14	14	6	8	0	0	2	10	6	2	0	2	4	4	0	0	0	0	8	4,857	
1986	7,136	278	227	206	81	38	29	18	13	14	7	13	11	4	8	8	7	1	11	6	10	8	6	7	7	24	8,178	
1987	11,118	358	332	349	236	116	90	51	49	43	34	39	11	15	19	24	17	13	11	15	19	11	4	15	13	94	13,096	
1988	7,154	336	332	235	143	71	42	23	26	12	7	5	9	14	7	14	12	9	9	14	16	0	0	2	12	38	8,545	
1989	9,457	130	147	117	117	81	43	13	9	13	4	4	4	13	6	9	9	6	11	4	11	9	15	9	6	11	10,256	
1990	2,700	169	152	192	126	79	40	17	3	10	10	13	10	13	3	3	7	3	10	0	13	0	7	10	0	30	3,621	
1991	9,074	110	33	63	98	93	48	18	10	10	10	20	18	18	8	13	3	8	8	5	3	0	3	0	3	18	9,689	
1992	18,969	1,739	1,153	625	606	450	411	312	117	215	98	78	39	39	39	20	78	98	59	117	20	20	0	39	20	117	25,476	
1993	18,876	2,176	1,300	877	589	522	433	289	189	200	100	100	67	122	33	22	33	44	33	44	0	77	33	22	33	255	26,472	
1994	36,547	1,711	1,182	1,412	1,393	935	723	441	458	318	212	247	123	177	177	194	88	159	141	88	35	88	71	52	88	194	47,255	
1995	14,122	1,338	971	801	594	622	386	386	160	113	66	94	66	38	94	94	47	56	75	38	56	56	9	38	9	66	20,395	
1996	10,798	4,772	3,462	1,310	997	874	686	655	436	311	436	405	250	250	311	311	467	467	282	188	188	188	250	156	188	561	29,201	
1997	13,737	2,081	954	321	225	182	147	130	87	61	156	113	61	95	35	43	61	69	52	35	61	35	26	17	26	61	18,869	
1998	3,646	194	61	64	38	88	76	64	75	52	30	44	32	21	22	15	26	13	16	8	12	11	6	4	6	15	4,641	
1999	9,799	3,348	1,647	220	55	110	110	55	110	55	110	0	0	165	0	110	0	110	0	0	0	0	0	55	55	0	16,111	
2000	9,736	372	262	39	52	65	84	100	78	78	65	55	45	52	39	26	49	23	26	13	32	10	0	3	13	32	11,347	
2001	14,628	1,649	812	225	149	220	212	194	191	147	143	122	87	118	64	69	82	71	52	28	54	29	14	22	34	57	19,475	
2002	5,492	1,306	643	178	118	175	168	154	152	116	113	97	69	94	50	55	65	56	41	22	42	23	11	17	27	45	9,329	

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL
2003	3,486	640	315	87	58	86	82	75	74	57	55	47	34	46	25	27	32	27	20	11	21	11	5	9	13	22	5,367
2004	8,703	1,324	652	180	120	177	170	156	154	118	115	98	70	95	51	56	66	57	41	22	43	24	11	18	27	46	12,593
2005	8,518	1,295	638	177	117	173	166	153	150	116	112	96	69	93	50	55	65	56	41	22	42	23	11	17	27	45	12,325
2006	8,539	1,299	640	177	117	174	167	153	151	116	113	96	69	93	50	55	65	56	41	22	42	23	11	17	27	45	12,355
2007	8,602	1,308	644	178	118	175	168	154	152	117	113	97	69	94	51	55	65	56	41	22	43	23	11	17	27	46	12,447
2008	8,780	1,335	658	182	121	179	171	157	155	119	116	99	71	96	52	56	67	57	42	23	43	24	11	18	27	46	12,704
2009	8,829	1,343	661	183	121	180	172	158	156	120	116	99	71	96	52	57	67	58	42	23	44	24	11	18	28	47	12,775
2010	8,691	1,322	651	180	119	177	170	156	153	118	115	98	70	95	51	56	66	57	41	22	43	24	11	18	27	46	12,575
2011-13	8,688	1,321	651	180	119	177	170	156	153	118	115	98	70	95	51	56	66	57	41	22	43	24	11	18	27	46	12,571

Table 11. Estimated total removals of Norwest Atlantic harp seals, 1952-2013.

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL
1952	219,536	16,162	25,580	17,342	13,292	14,558	24,120	16,690	16,290	11,934	13,642	11,517	3,861	3,129	4,568	8,554	3,015	4,660	3,739	2,121	11,017	1,858	94	952	2,704	3,588	454,522
1953	219,447	46,686	14,724	13,290	8,792	8,920	7,276	6,164	6,226	5,980	5,146	5,983	3,777	2,913	2,248	4,018	4,151	3,010	1,955	1,499	5,317	3,440	1,966	1,330	998	910	386,165
1954	199,519	69,652	27,513	9,902	12,719	6,824	8,358	7,227	6,589	4,503	6,357	2,809	5,566	5,257	2,857	4,074	4,583	2,248	831	2,411	1,921	738	669	1,526	385	2,396	397,434
1955	273,296	48,805	18,973	13,717	9,894	8,789	8,099	6,723	6,987	5,605	6,353	5,508	4,351	3,278	2,523	4,804	4,328	2,916	1,616	1,684	4,975	2,715	1,647	1,311	1,119	1,611	451,625
1956	357,914	27,881	11,111	7,948	6,236	5,017	4,867	4,223	4,435	3,813	4,053	3,398	2,862	2,135	1,859	2,959	2,781	1,895	1,270	1,264	3,197	1,568	991	843	765	1,097	466,385
1957	182,432	47,669	17,676	12,163	9,643	7,877	7,617	6,580	6,648	5,724	6,396	5,768	4,413	3,577	2,809	4,942	4,493	3,013	1,684	1,785	5,040	2,698	1,670	1,293	1,150	1,771	356,529
1958	162,465	54,293	21,747	24,445	25,043	21,049	14,027	12,650	10,656	10,062	19,836	11,776	14,472	8,515	6,504	18,005	11,869	6,171	1,265	3,152	10,987	5,912	4,945	2,097	4,025	7,372	493,338
1959	251,899	46,855	17,687	12,102	9,334	8,123	8,013	6,829	6,807	5,937	6,557	5,593	4,318	3,431	2,708	4,963	4,423	2,984	1,585	1,749	4,992	2,679	1,612	1,325	1,118	1,650	425,272
1960	176,927	70,511	27,383	20,804	14,367	11,958	11,962	9,771	9,467	8,141	9,289	8,070	6,298	4,962	3,770	7,047	6,500	4,284	2,310	2,442	7,368	3,959	2,401	1,913	1,649	2,431	435,985
1961	184,800	14,143	5,578	5,334	5,838	2,290	2,682	2,444	1,608	1,510	2,216	1,319	863	771	783	620	641	540	317	368	488	94	237	186	95	415	236,178
1962	219,330	61,960	69,026	19,974	18,278	12,876	5,868	5,332	5,440	5,336	2,494	2,682	3,950	2,055	2,842	4,085	1,443	3,463	1,627	1,264	2,748	397	1,273	116	369	1,322	455,550
1963	284,999	20,494	18,044	14,511	8,611	6,825	7,460	7,410	7,056	6,492	7,534	7,157	5,359	5,661	5,727	4,631	5,409	3,766	2,483	1,988	2,103	1,799	1,340	1,061	908	1,358	440,187
1964	279,868	13,629	12,218	12,606	13,994	9,408	13,564	7,304	5,896	5,552	8,554	4,528	4,517	3,437	3,435	5,306	4,179	5,173	7,838	4,153	328	4,004	2,054	2,037	2,956	5,071	441,609
1965	195,499	25,698	12,488	10,457	10,679	12,683	11,620	4,746	2,258	1,568	2,806	1,023	3,542	678	2,568	2,383	1,244	789	1,467	1,564	697	1,026	536	111	138	1,471	309,740
1966	261,978	28,843	22,716	10,839	10,325	10,587	10,496	9,596	6,457	3,499	3,711	4,661	3,432	3,041	3,417	3,022	2,883	2,081	3,130	1,982	2,178	1,533	668	1,324	772	2,189	415,362
1967	285,596	29,407	13,714	5,915	4,983	6,679	8,256	7,200	5,031	3,317	3,045	3,752	2,668	2,074	3,069	3,202	2,036	2,579	2,775	2,864	1,940	1,237	908	1,014	638	1,922	405,820
1968	166,413	13,294	9,808	6,641	4,053	3,559	3,467	4,731	4,738	3,288	3,358	2,512	2,047	1,840	2,385	2,183	1,902	1,660	2,309	2,016	1,533	919	1,216	660	508	1,274	248,314
1969	243,285	43,884	6,955	6,705	5,412	5,896	4,358	4,966	5,895	4,339	3,751	3,268	2,237	2,450	2,514	2,728	1,694	2,671	1,722	1,937	1,684	1,177	739	881	449	1,488	363,085
1970	226,420	18,572	15,700	6,335	5,580	5,418	3,201	3,240	3,537	3,273	4,086	2,777	2,473	1,929	1,627	1,878	1,942	1,158	1,132	1,158	1,261	844	662	536	402	785	315,929
1971	220,222	16,738	6,082	5,430	2,690	2,416	1,592	1,282	1,092	1,636	1,681	1,231	1,226	820	608	663	465	418	422	337	272	228	248	124	54	703	268,682
1972	125,453	9,950	5,944	3,585	3,489	1,682	1,455	1,192	809	418	646	644	707	371	522	545	305	337	406	242	520	297	216	158	138	283	160,313
1973	109,989	14,063	9,738	6,701	5,103	6,887	2,395	2,097	2,321	1,395	1,458	1,632	1,395	1,313	957	1,026	900	590	443	479	544	170	372	114	118	580	172,779
1974	125,441	23,773	12,998	4,843	4,009	3,863	5,662	1,828	2,011	2,217	1,571	1,166	1,488	1,398	1,065	960	994	866	564	527	346	294	340	208	288	926	199,645
1975	150,727	28,924	13,741	6,997	3,864	3,385	3,051	2,991	1,753	1,333	1,811	1,165	1,221	1,041	817	692	663	506	484	440	308	298	162	168	178	144	226,865
1976	148,881	34,799	16,824	9,228	5,945	2,030	1,363	1,249	1,284	553	867	742	691	412	498	644	373	346	190	178	220	139	86	114	82	86	227,825
1977	149,464	18,238	12,900	11,273	8,194	4,136	2,338	1,762	1,106	513	655	636	509	470	804	920	459	187	132	84	152	103	105	106	80	137	215,464
1978	133,850	42,054	24,317	14,908	10,059	6,787	4,839	1,598	2,150	907	1,464	642	700	640	483	662	375	337	344	212	333	273	239	142	85	481	248,883
1979	154,521	35,164	16,921	8,444	4,871	3,380	2,423	1,537	990	813	569	421	466	340	562	655	332	393	275	303	305	257	234	186	171	1,069	235,601
1980	144,684	39,709	19,333	13,351	7,553	5,351	4,209	3,102	2,351	1,623	1,198	1,419	1,331	938	1,079	1,308	950	796	286	504	719	383	339	210	212	955	253,896
1981	196,163	27,800	14,312	11,439	8,254	6,392	4,462	2,897	2,209	1,093	1,421	1,416	1,068	783	697	973	690	747	564	598	489	546	532	307	249	856	286,958
1982	167,072	31,240	18,303	10,835	5,755	4,610	2,546	2,729	1,636	2,096	1,460	1,303	668	765	418	844	454	607	399	542	630	565	277	377	187	753	257,071
1983	71,044	20,788	10,383	7,673	5,414	2,898	2,632	2,184	1,106	1,136	1,153	802	749	401	408	754	507	504	369	394	395	221	104	139	127	363	132,648
1984	36,565	12,339	13,910	11,179	6,729	4,342	3,290	2,702	2,043	1,025	1,159	1,166	753	642	617	1,063	740	701	606	551	769	719	452	619	496	775	105,952

YEAR	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25+	TOTAL
1985	24,522	11,027	10,753	9,542	5,342	3,455	2,674	2,148	1,816	879	1,059	770	497	591	619	935	613	548	556	552	689	432	383	345	305	573	81,627
1986	37,954	12,326	10,972	10,739	5,929	3,855	3,006	2,386	1,956	1,013	1,085	1,000	642	683	551	1,000	736	647	709	604	789	584	505	472	419	705	101,269
1987	60,516	18,198	16,341	16,410	9,904	6,217	4,814	3,595	3,083	1,667	1,687	1,601	772	1,028	819	1,437	1,093	976	941	905	1,131	811	667	731	624	1,763	157,731
1988	89,515	28,401	26,513	22,512	13,333	7,993	5,689	4,107	3,691	1,704	1,632	1,402	1,048	1,466	904	1,783	1,414	1,247	1,240	1,335	1,606	725	652	683	972	2,214	223,781
1989	81,362	18,919	17,477	16,613	10,775	7,364	5,216	3,636	3,003	1,593	1,506	1,370	793	1,244	796	1,469	1,190	1,061	1,156	907	1,245	964	1,036	821	675	997	183,187
1990	52,236	26,401	23,476	25,552	15,622	10,287	6,706	4,449	3,137	1,920	2,031	2,083	1,283	1,745	860	1,509	1,415	1,142	1,518	846	1,795	802	1,099	1,218	551	2,485	192,168
1991	67,740	21,462	16,681	17,508	12,227	9,231	6,295	4,275	3,436	1,758	1,866	2,074	1,340	1,636	953	1,801	1,172	1,251	1,253	1,056	1,170	840	843	684	663	1,425	180,640
1992	79,926	33,592	26,274	21,504	14,530	10,228	8,427	6,535	4,248	3,328	2,423	2,117	1,098	1,417	1,059	1,592	1,807	1,879	1,546	1,932	1,297	1,047	791	1,052	770	1,872	232,292
1993	79,802	34,249	27,515	29,027	21,230	14,375	11,078	7,706	7,174	4,103	3,378	3,514	1,777	2,569	2,159	3,063	1,940	2,376	2,256	1,704	1,519	1,660	1,432	1,206	1,350	2,465	270,626
1994	68,262	37,725	30,726	28,537	17,907	14,643	10,229	8,926	5,700	3,018	2,586	2,761	1,600	1,711	1,887	2,713	1,882	1,861	2,089	1,521	1,964	1,686	1,062	1,283	827	1,772	254,878
1995	226,819	61,732	48,613	32,510	20,476	15,424	11,934	10,164	7,747	4,305	5,297	4,929	2,798	3,321	3,227	4,168	4,986	4,835	3,508	2,643	2,904	2,599	2,940	2,148	2,206	5,310	497,542
1996	265,628	62,264	38,415	26,589	15,970	11,477	8,895	7,133	5,655	2,871	4,597	3,744	1,864	3,033	1,426	2,374	2,476	2,483	2,221	1,744	2,413	1,721	1,464	1,213	1,207	2,171	481,048
1997	291,546	41,276	28,455	28,117	16,140	15,105	12,030	9,520	9,474	5,337	3,835	4,719	2,822	2,786	2,230	2,709	3,202	2,223	2,504	1,777	2,245	1,965	1,526	1,286	1,222	2,213	496,262
1998	286,564	43,753	33,266	28,084	15,767	11,125	8,509	6,356	5,668	2,424	2,506	2,132	859	2,188	948	2,274	1,761	1,896	1,649	1,411	1,638	1,406	1,284	1,339	1,111	1,395	467,313
1999	127,377	38,571	32,137	29,298	16,966	12,008	9,432	7,496	6,367	3,125	2,897	2,781	1,340	2,256	1,374	2,275	2,329	1,849	1,991	1,613	2,039	1,578	1,355	1,259	1,113	1,786	312,615
2000	265,110	40,002	30,482	26,474	15,201	11,189	8,737	6,820	6,008	2,930	2,826	2,678	1,307	2,222	1,249	2,183	2,102	1,837	1,819	1,463	1,823	1,465	1,261	1,199	1,060	1,618	441,065
2001	338,044	35,034	25,767	21,328	12,306	9,294	7,354	5,821	5,164	2,650	2,577	2,399	1,252	2,022	1,143	1,905	1,847	1,617	1,554	1,224	1,573	1,224	1,027	996	915	1,405	487,440
2002	317,355	30,577	23,500	20,577	11,824	8,659	6,757	5,282	4,638	2,257	2,195	2,072	1,022	1,707	973	1,714	1,624	1,425	1,411	1,143	1,424	1,139	983	932	822	1,249	453,261
2003	401,079	34,930	26,198	22,254	12,814	9,541	7,501	5,901	5,212	2,610	2,537	2,377	1,208	1,985	1,124	1,921	1,846	1,617	1,576	1,256	1,592	1,255	1,067	1,024	923	1,411	552,761
2004	375,601	38,037	30,367	27,836	15,933	11,387	8,777	6,775	5,901	2,724	2,636	2,530	1,164	2,044	1,165	2,164	2,023	1,775	1,809	1,498	1,815	1,493	1,320	1,227	1,043	1,573	550,616
2005	399,585	39,864	31,331	28,211	16,167	11,666	9,033	7,003	6,121	2,883	2,790	2,663	1,256	2,171	1,234	2,244	2,114	1,854	1,870	1,534	1,877	1,530	1,340	1,255	1,082	1,637	580,316
2006	265,460	33,022	26,790	24,988	14,289	10,116	7,765	5,971	5,181	2,345	2,273	2,192	986	1,753	1,005	1,906	1,764	1,550	1,595	1,334	1,600	1,327	1,183	1,092	916	1,376	419,778
2007	260,857	30,218	25,124	24,049	13,729	9,587	7,310	5,586	4,820	2,113	2,048	1,993	860	1,570	905	1,775	1,622	1,427	1,492	1,265	1,496	1,258	1,135	1,037	853	1,272	405,402
2008	110,192	27,049	22,511	21,561	12,311	8,593	6,553	5,010	4,322	1,895	1,841	1,789	776	1,408	814	1,597	1,455	1,281	1,339	1,136	1,344	1,128	1,019	930	765	1,141	239,762
2009	106,719	33,668	28,005	26,830	15,312	10,689	8,146	6,220	5,368	2,347	2,271	2,213	950	1,744	1,003	1,971	1,803	1,586	1,661	1,409	1,663	1,401	1,265	1,156	949	1,416	267,764
2010	72,377	27,703	23,067	22,107	12,622	8,807	6,715	5,133	4,427	1,939	1,883	1,831	792	1,440	832	1,635	1,489	1,311	1,371	1,164	1,376	1,156	1,044	953	783	1,168	205,129
2011	106,290	29,446	24,511	23,489	13,409	9,357	7,134	5,450	4,702	2,058	1,996	1,942	838	1,529	882	1,733	1,581	1,391	1,456	1,236	1,460	1,228	1,109	1,013	832	1,241	247,313
2012	375,601	38,037	30,367	27,836	15,933	11,387	8,777	6,775	5,901	2,724	2,636	2,530	1,164	2,044	1,165	2,164	2,023	1,775	1,809	1,498	1,815	1,493	1,320	1,227	1,043	1,573	550,616
2013	399,585	39,864	31,331	28,211	16,167	11,666	9,033	7,003	6,121	2,883	2,790	2,663	1,256	2,171	1,234	2,244	2,114	1,854	1,870	1,534	1,877	1,530	1,340	1,255	1,082	1,637	580,316

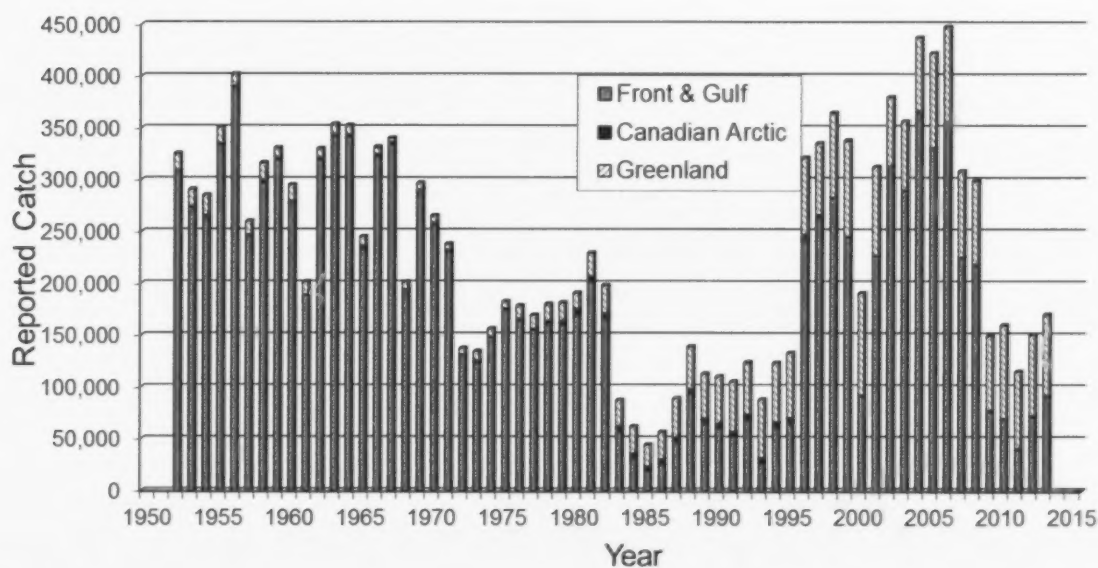


Figure 1. Total reported catches of harp seals in the Northwest Atlantic 1952-2013.

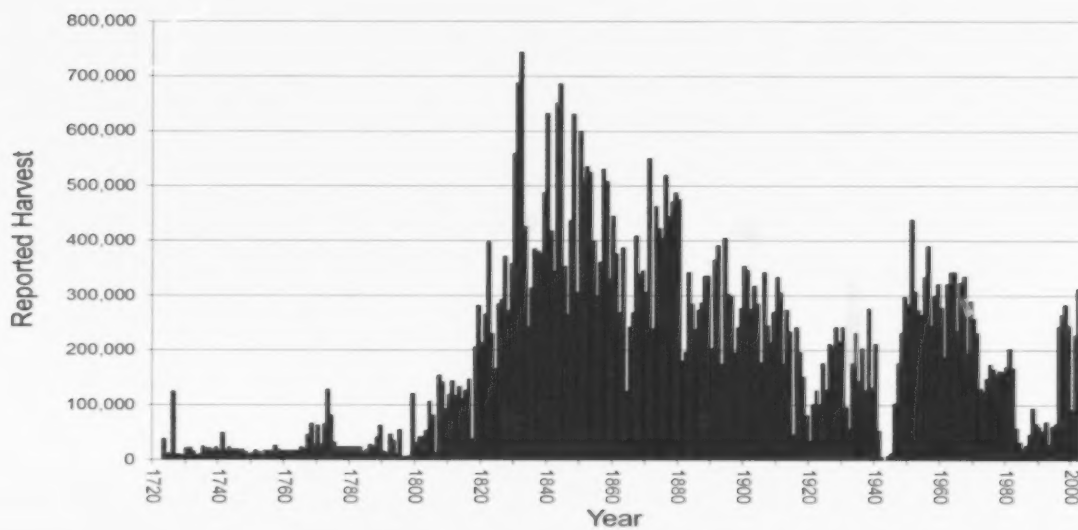


Figure 2. Historical catches of harp seals in Canadian and Newfoundland waters, 1720-2000.

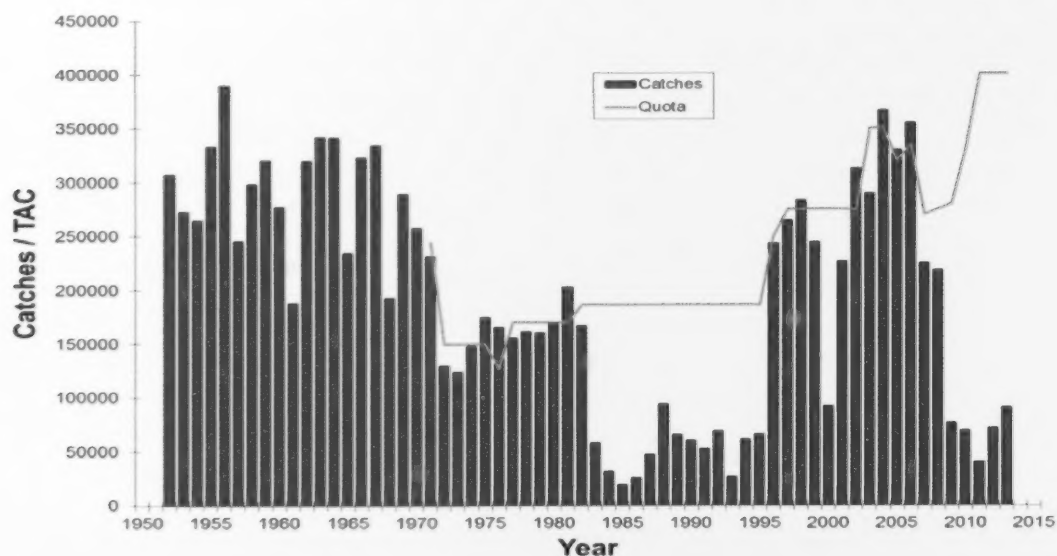


Figure 3. Commercial Catch and Total Allowable Catch of harp seals in southern Canadian (Front and Gulf) areas 1952-2013.

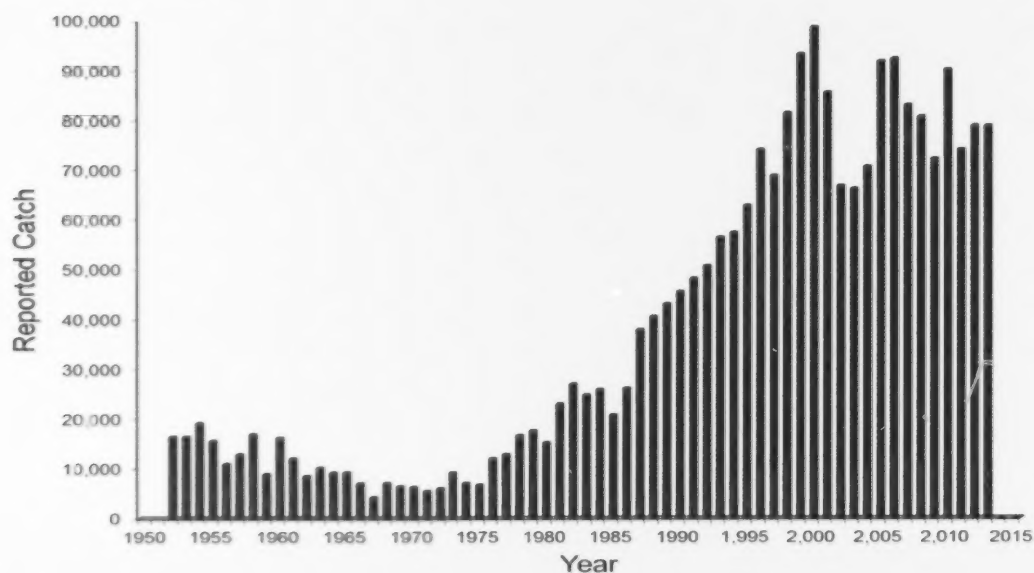


Figure 4. Reported catches of Northwest Atlantic harp seals in Greenland waters 1952-2013. Values for 1952-53, 1988-92 and 2010-13 are estimated (see text).

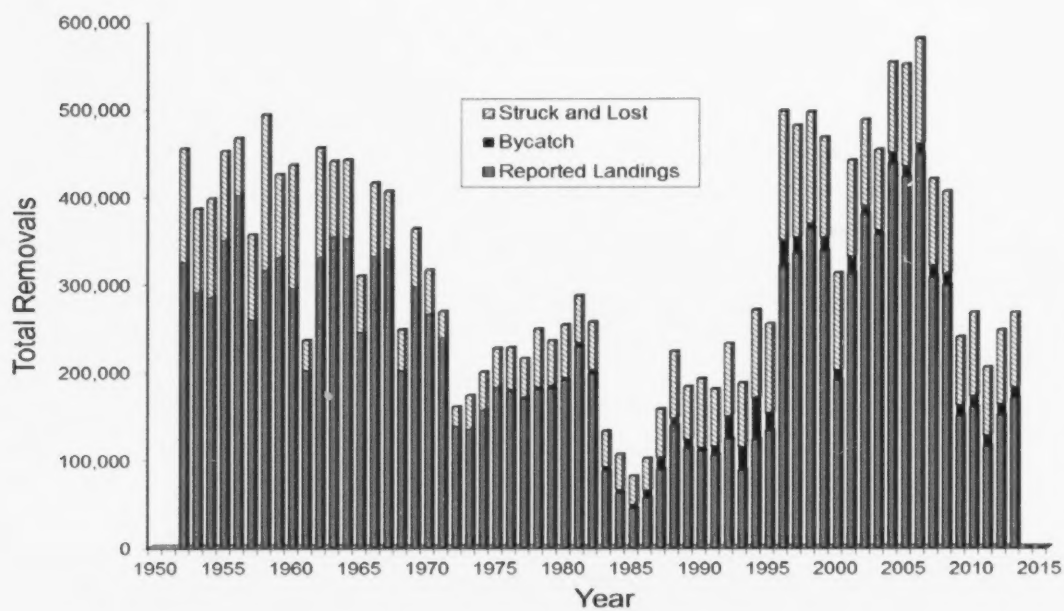


Figure 5. Total removals of Northwest Atlantic harp seals, 1952-2013.

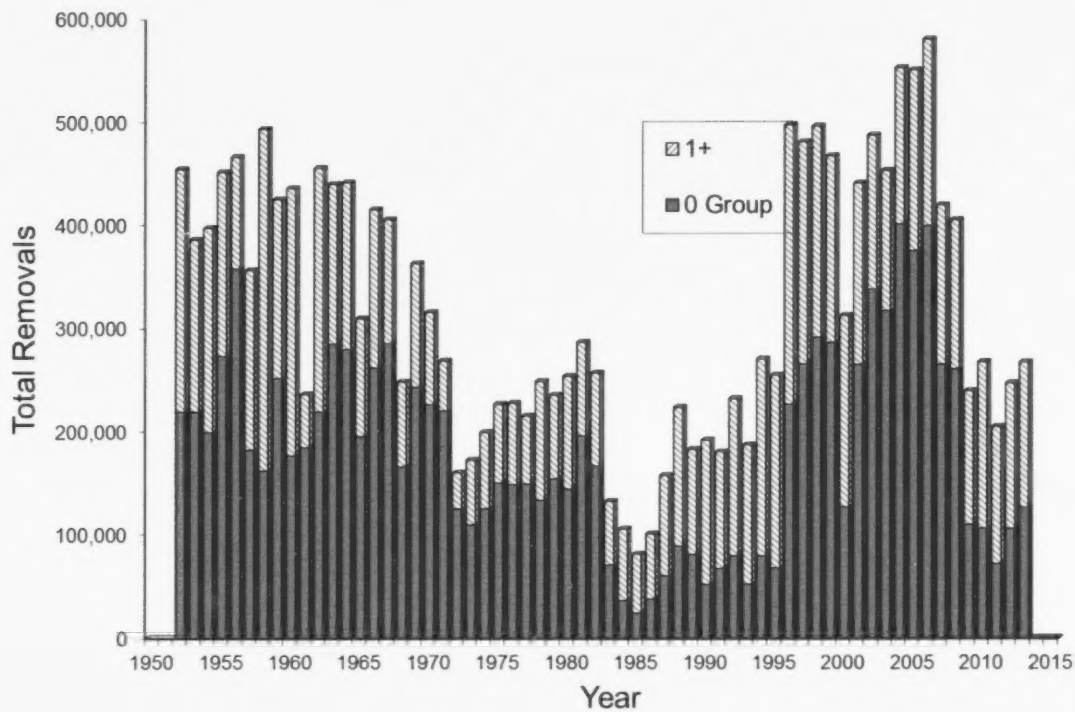


Figure 6. Total removals of Northwest Atlantic harp seals, 1952-2013, separated by age class.